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GLACIERS OF PRINCE WILLIAM SOUND AND THE SOUTHERN PART OF THE KENAI PENINSULA, ALASKA

I.—GLACIERS OF THE NORTHERN PART OF PRINCE WILLIAM SOUND*

BY

U. S. GRANT AND D. F. HIGGINS

Prince William Sound (Fig. 1) is the large body of water extending inland from the northernmost part of the Gulf of Alaska. Its many islands and lofty shores contain ample evidence, in their glacial valleys, their deep fiords, their hanging valleys, their cirques, their rounded mountains, and their morainal deposits of profound glacial action in geologically recent times. From mountains of 2,000 to 10,000 feet in height flow down ice streams to-day which are the attenuated remnants of a vast ice field which once covered the region almost completely.

Prince William Sound was known to the Russians as Chugach Gulf. It is not a sound according to the customary usage of that term, but is an extensive bay or gulf which includes many islands. Its coast line is indented by numerous long, narrow inlets or fiords and by other less regular embayments whose shores are commonly of great complexity. The whole district is a highly dissected mountain mass which has been glaciated and then partially drowned in the sea. The form of the surface and the relations of land to water

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are similar to those which exist in the well-known "inside passage" of southeastern Alaska. The coast is rugged, rocky and picturesque and in many places rises abruptly from the water's edge to heights of 1,000 to 3,000 feet. Great mountains surround Prince William Sound on its east, north, and west sides and exist also on the islands at the entrance to the sound. These mountains contain large numbers of snow fields and glaciers, and magnificent views of snow-clad peaks and ice streams may be had from steamers crossing the

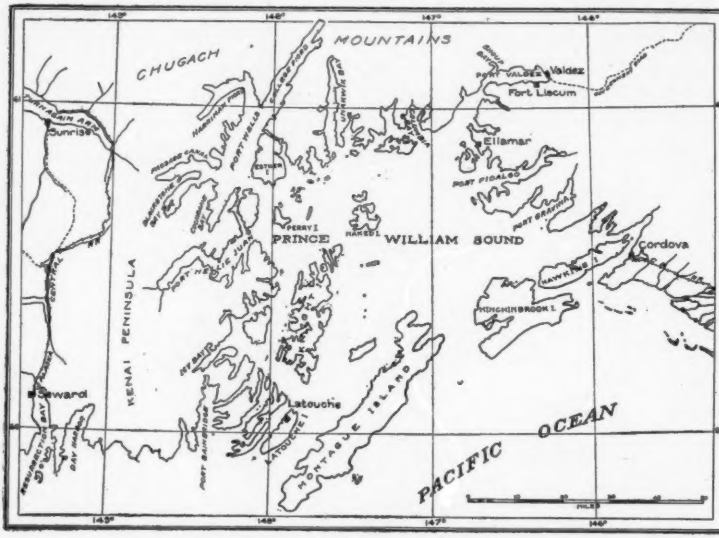

FIG. 1—Map of Prince William Sound, Alaska. Glaciers are abundant in the mountains on all sides of the sound and frequently descend to the sea in the fiords and bays of the north and west shores of the sound.

sound. In the bays and fiords of the northern and western portions glaciers frequently reach tide water and discharge their icebergs from giant ice cliffs.

Valdez Glacier

The Valdez Glacier (Figs. 2 and 3), located near the northeastern extremity of Prince William Sound, is the most noted of this district. During the spring and summer of 1898 and the early part of 1899 this glacier was used as a roadway by the horde of gold-seekers passing northward from Valdez into the Copper River and Yukon basins. The construction in 1899 of the military telegraph line and trail (followed by the development in later years of

the trail into wagon road) from Valdez northward over Thompson Pass into the Copper River basin has taken away the necessity of travel over the Valdez Glacier. The front of the glacier is covered with débris, has a low slope, and is easy of ascent, although in 1898 within the first five hundred feet of rise there were three marked benches, each about 100 feet high, over which passage was difficult. The glacier itself and the method of travel over it have been interestingly described by Schrader.*

The front of the Valdez Glacier is about four miles back of the town of Valdez (Fig. 2), where it projects out of a deep valley onto a gravel plain and shows from the town in a gently curved profile (Fig. 3). There is no forest near the front of the ice, and the present thus seems to be a period of general retreat for this glacier.

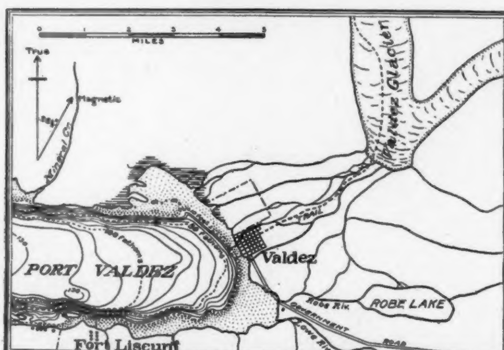

FIG. 2—Map of the head of Port Valdez and vicinity. Submarine contour lines are from data on charts of the U. S. Coast and Geodetic Survey.

There is, however, a good covering of shrubs on the valley wall near the glacial front, and close to the ice a narrow zone bare of vegetation. Thus there has been no extensive advance of the ice front beyond its present position during the twentieth century. Still oscillations of the front, as noted below, have taken place within the last few years.

We photographed the front of the Valdez Glacier in July, 1905, and the mound from which these photographs were taken was destroyed by an advance of the ice sometime before July, 1908, when we visited the glacier again and found its front about 100 feet in advance of its 1905 position. Sometime in this interval a moraine,

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* Schrader, F. C. A reconnaissance of a part of Prince William Sound and the Copper River district, Alaska, in 1898: *Twentieth Ann. Rept.* U. S. Geol. Survey, Pt. 7, 1900, pp. 350–356, 365–366, 381–382.

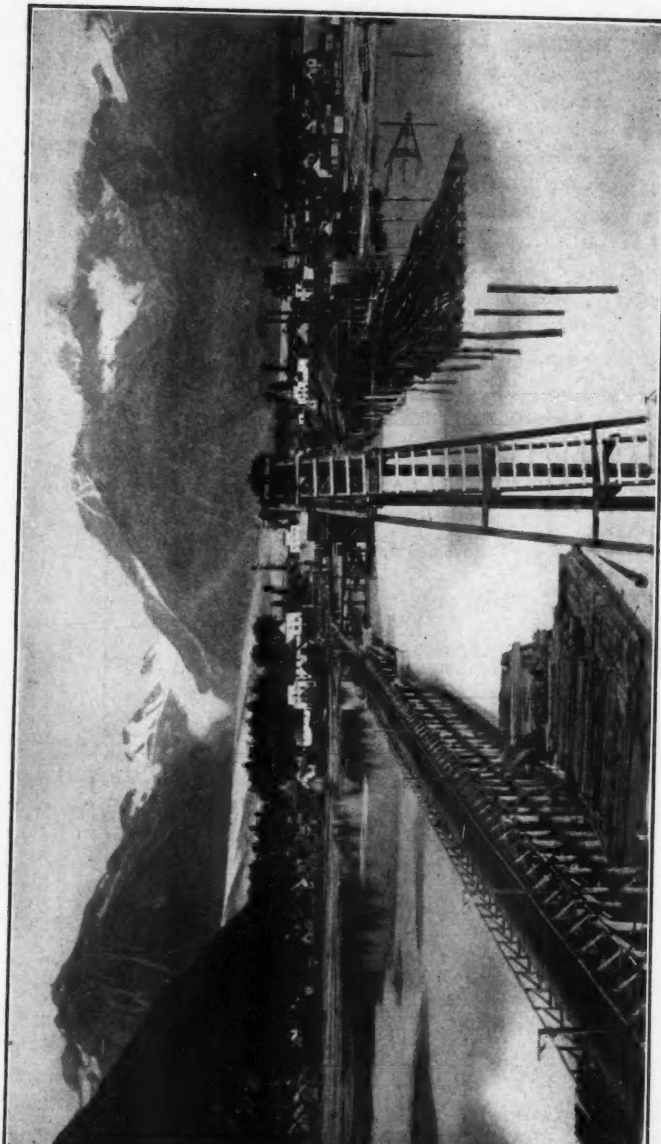


FIG. 3—Valdez and the Valdez Glacier, August, 1905. Photographed by P. S. Hunt.

10 to 30 feet in height and 25 to 125 feet wide, was deposited 250 to 300 feet in advance of the position of the front of the ice in 1905.

The plain in front of the Valdez Glacier is composed of glacial gravels deposited by the rapidly shifting and often turbulent glacial streams. Figure 4 shows these interlacing streams and the areas kept bare of vegetation by their rapid changes of courses. The white color of the streams is due to the large quantities of powdered rock, "rock flour," held in suspension. Streams from underneath

Fig. 4—Head of Port Valdez and the town of Valdez from mountain to the northwest. Photographed by G. O. Cantwell. The delta formed by Robe River and the streams from the Valdez Glacier (see Fig. 2) is gradually pushing forward into Port Valdez. Valdez is behind point shown by the two piers. Photograph taken near time of low tide.

moving glaciers always contain this finely divided solid matter. The streams are building the plain seaward, gradually filling in the deep rock trough of Port Valdez. The position of the outer ends of the wharves (Figs. 2 and 4) marks the change to the steeper submarine front of the advancing delta. The subærial slope of the plain is about 1 foot in 80, or an angle of about 40′; while the submarine

slope averages 1 foot in 5, or 12°. The rocky submarine walls of the fiord average about 24° slope or nearly 1 foot in 3, though in one place the slope is more than one to one for 750 feet. The shape of the bottom of the fiord is shown in submarine contours in Figure 2. It is a flat-bottomed trough which was cut out to a depth of 600 to 800 feet below present sea level by the huge ice stream which once filled the whole valley to a depth of nearly 4,000 feet.

It seems quite probable that occasional slumping is taking place along the seaward edge of the delta. On February 14, 1908, a considerable earthquake visited this district and broke in several places both the Seattle-Valdez and the Valdez-Seward cables which run east and west through Port Valdez. Accompanying the earthquake there seems to have been a slumping of the delta front and a consequent burying of sections of the cables. The cause of the earthquake is not known, but it is thought to have been minor faulting, for one of the cables was broken in deep water on the flat bottom of the fiord, eleven miles from Valdez. The slumping of the delta front at this time was thus probably a result rather than a cause of the earthquake.

Shoup Glacier

At the northwestern angle of Port Valdez a considerable ice tributary joined the ancient trunk glacier of the main valley. With the melting and disappearance of the larger ice stream this side glacier was separated, and it is now known as the Shoup Glacier. It serves as the perennial icehouse for Valdez and Fort Liscum, the detached bergs being lifted upon barges and taken to these towns.

We mapped (Fig. 5) and photographed the glacier on June 16th, 1909. Photographs from the same point were also taken in July, both 1905 and 1908. Its front has been practically stationary during these years, but the confused records of earlier dates make it impossible to say just what was the history of advance and retreat prior to 1905. The considerable size of the shrubs close to the front of the glacier shows, however, that there has been no appreciable advance beyond the present position for probably several decades. It is reported that the rock ledges shown in Fig. 5 were not visible in 1900 and 1901. It would require an advance from the 1909 position of only about 50 feet to cover these ledges.

The submarine contours of Shoup Bay and the adjacent part of Port Valdez as shown in Fig. 5 furnish a most interesting example of a submerged hanging valley. The bottom of Shoup Bay is more than 500 feet above the bottom of Port Valdez. The gravel bar

across the opening of the bay is an old terminal moraine formed when the front of the glacier was at the mouth of the bay. If the land were to emerge more than about 20 feet Shoup Bay would be a fresh water lake held in by the morainal dam. If the waters of

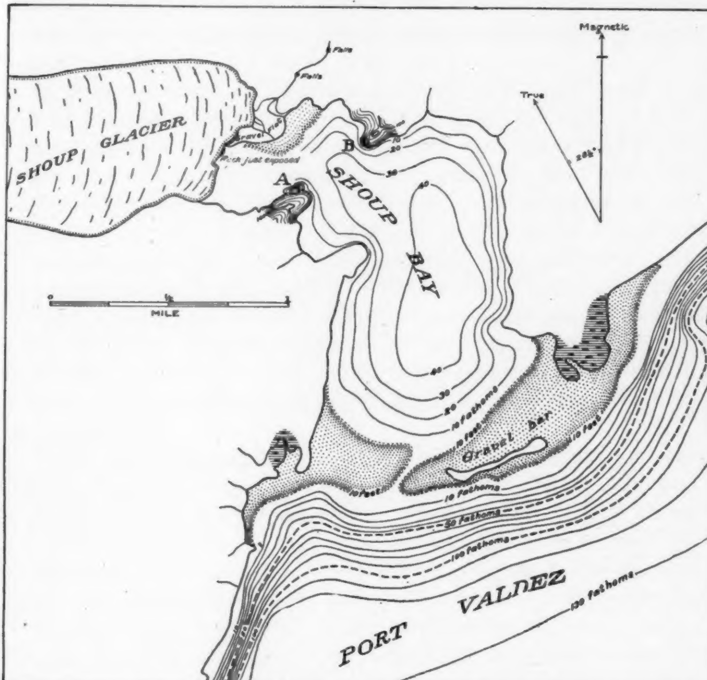


FIG. 5—Map of Shoup Glacier and vicinity, June 19, 1909. Submarine contour lines are from data on charts of the U. S. Coast and Geodetic Survey. Shoup Bay is a drowned hanging valley on the side of Port Valdez. A and B are points from which photographs of the glacier were taken in 1905, 1908 and 1909. Contour interval on land is 20 feet.

Port Valdez were to be drawn off to the extent of 300 or 400 feet the lake would then be in an ordinary hanging valley up on the side of the trough of Port Valdez.

Columbia Glacier

The most interesting and the most magnificent glacier of Prince William Sound and the Kenai Peninsula is the Columbia at the head of Columbia Bay. (See Figs. 1 and 6.) This is one of the great tide-water glaciers of Alaska and of the world, and is, moreover, easily accessible to the tourist and the lover of nature.

Heading northward into the west arm of Columbia Bay we found a line of gleaming white across the head of the bay. Approaching the glacier the white line revealed itself as a tremendous wall of ice two and a quarter miles long and 400 feet high. The booming and crashing of the ice as it broke off into the sea added

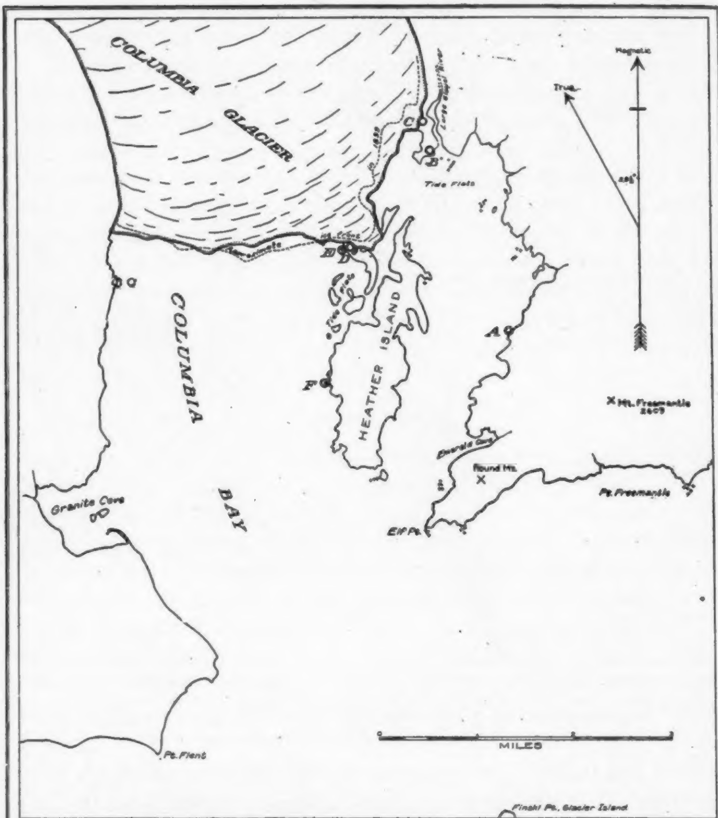


FIG. 6—Map of the front of the Columbia Glacier and vicinity, June, 1909. The points marked by circles are stations from which photographs were taken.

the last touch to make this wild and fascinating scene one never to be forgotten. Fig. 7 shows the ice wall at a distance of about a mile, with the Columbia Nunatak in the background. Even the intrepid photographer did not dare to go nearer to the jaws of this giant, for the waves caused by the falling of the ice made close ap-

proach in small boats exceedingly dangerous. Small pieces of ice falling from the ice face strike the water with a sound like the snap of a rifle, while larger pieces descend with the roar of thunder, sometimes throwing the water to the height of the ice cliff. The waves generated by these ice blocks cause havoc on the adjoining shores far above the height here reached by the greatest storm waves.

In 1899 the Harriman Alaska Expedition visited this glacier and Gilbert* wrote an excellent description of it at that date. At the western edge of the glacial front Gilbert's description and photograph show a bare zone between the forest and the ice of from 200 to 300 feet in width. This locality was not examined by us in 1905 and 1908. In 1909, however, the glacier had advanced sufficiently to cover the entire bare zone and to encroach upon the forest itself. The forest is now being attacked by the ice and considerable havoc has been done by the streams along the side of the glacier and by waves caused by the fall of icebergs. We estimate that the ice at its western edge is now (1909) 500 feet in advance of its position in 1899, and that this advance has taken place, in the main, since July, 1908.

At the east edge of the glacier a swift muddy stream of considerable size enters the bay. The tongue of land between stations B and C of Fig. 6 is a sharply rolling grassy stretch. Fig. 8 shows the view from station B looking southwest. Here is a beautiful example of knob and kettle topography developed a few decades ago. The clump of trees in the left middle ground is a tiny remnant of the forest which covered all this land before the ice invasion. The largest spruce trees on the new topography are about six inches in diameter, and they are perhaps twenty years of age. But since our observations lead us to believe that vegetation gains a foothold very slowly on new glacial soil in this region of Alaska, we estimate the date of this advance at about fifty years ago. This is the earliest position of the front of which we have record since the growth of the present forest.

Morainal deposits at the north end of Heather Island, however, contain many fragments of shells of pelecypods and gasteropods which seem to be of recent species. It is improbable that these forms live in the cold milky waters near the melting ice, and so the presence of their remains in the recently deposited drift would indicate that the ice front was, in geologically recent time, considerably farther north than at present. The head of the north end of the

* Gilbert, G. K. "Harriman Alaska Expedition," Vol. 3, 1904, pp. 71-81.

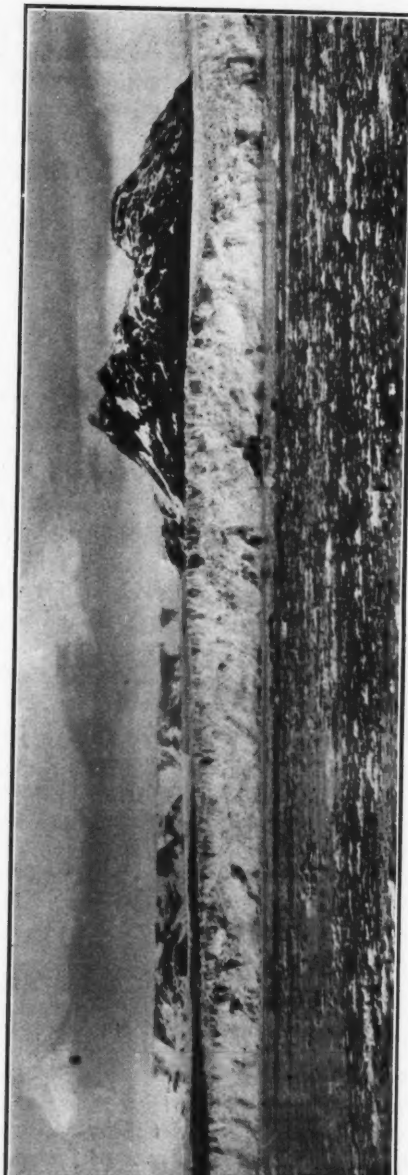


FIG. 7—Front of the Columbia Glacier and the nunatak. Photographed by P. S. Hunt.

eastern part of Columbia Bay is shallow and it is possible that a retreat of the ice front of not more than a mile might have exposed ground above tide water so shaped that the drainage from the eastern part of the glacier would have been diverted to the westward, leaving the eastern portion of Columbia Bay free of glacial waters. This condition would be favorable to the growth of molluscan life.

It was on the largest of the small islands northwest of Heather Island, however, that we found the most interesting features of the Columbia Glacier. It was here, at station D (Fig. 6), that photographs have been taken from practically the same point five times

Fig. 8—Front of the Columbia Glacier from Point B (Fig. 6), June, 1909. At the left is the remnant of the forest destroyed by the advance of the glacier perhaps fifty years ago, and the morainic topography of the foreground was developed at or very shortly after the same date.

in an interval of ten years. Gilbert's photograph, taken June 26th, 1899, is here reproduced as Fig. 9, and our view, taken June 24th, 1909, is Fig. 10. The same trees and rocks can readily be recognized in each. The man standing on the small push moraine in Fig. 9 is Mr. W. A. Dickey, of Landlocked Bay, Prince William Sound. His place, in the later view, has been overrun by a few feet of ice.

Although the ice shows in both these photographs, the front was well out of view in July, 1905, to the north (left); and in July, 1908, it was just in the edge of the picture. Briefly, the history here

Fig. 9—Front of the Columbia Glacier and overturned forest, 1899. Photographed by G. K. Gilbert.

Fig. 10—Front of the Columbia Glacier and overturned forest, 1909. Photographed from the same station (D in Fig. 6) as Fig. 9. In the ten years between the dates of the two photographs much grass has grown in the foreground. In the last year the glacier has advanced, destroyed some of the trees and pushed forward others (especially the nearly erect, dead, almost branchless, tall tree on the right).

recorded is as follows: At a date estimated as 1894 the large push moraine which contains the bare dead trees and the tilted living trees was formed. We infer a still earlier advance, however, for the bare, dead trees had undoubtedly been killed before the pushing up of this moraine. Then there was a retreat an unknown distance, followed by an advance to form the small push moraine on which Mr. Dickey stood. In 1899 the distance from the small moraine to the ice was found to be 60 feet. In 1905 the ice was 220 feet north of the small moraine, but in 1908 it had advanced 100 feet. Between July 15th, 1908, and June 24th, 1909, the ice pushed forward 310 feet, and by August 23rd, 1909, as observed by Tarr and Martin, it was seventy feet (estimated) farther out and 120 feet ahead of its former (1894) maximum. Between the last two dates there was then an average rate of advance of the front of 1.17 feet per day. The actual rate of movement of the ice was considerably greater than this, for melting was at its maximum during this period.

The photographs (Figs. 9 and 10) are also of interest in showing the growth of vegetation on a freshly exposed till surface. In the first year or two no vegetation had gained a foothold. In the next six years very little grass had started to grow, though considerable fire weed (*Epilobium*), which is one of the first plants to cover the ground recently bared by ice, was much in evidence in the outer part of the bare zone. In 1909 the ground was well covered by grass, but no trees nor shrubs had put in their appearance. A number of tilted trees which were alive in 1899 had died by 1905 and still others by 1909. The dropping of twigs and bark from the dead trees, and the general decay of the trunks, progressed comparatively little between 1899 and 1909. The impression which we gathered from our visits to several such areas of forest invaded by ice and of ground recently bared is that the time since the ice invasion is very likely to be underestimated. Were it not for the evidence of dated photographs, an examination of this locality in 1909 very likely would have convinced us that the former maximum of the ice was four or five years ago rather than fifteen or more years ago.

Figs. 11 and 12 portray graphically the movement of the ice front between 1908 and 1909. The tree showing faintly at the extreme left of Fig. 11 is the lower (dead) tree in Fig. 12.

Nothing could give a more impressive illustration of the tremendous force in the moving ice than the uprooted trees and folded layers of peaty soil on this little island. No motion was visible, and an occasional snap of an overstrained piece of wood was all that

gave evidence of active movement. In the advance of the ice, in 1909, into the previously disturbed forest some of the trees were pushed forward bodily without being overturned, although their inclinations were sometimes changed. One such tree had its position changed by 100 feet by June 24, 1909, and by Aug. 23 of the same year it had been moved further, but was still nearly upright.

Fig. 11—Front of the Columbia Glacier, 1908.

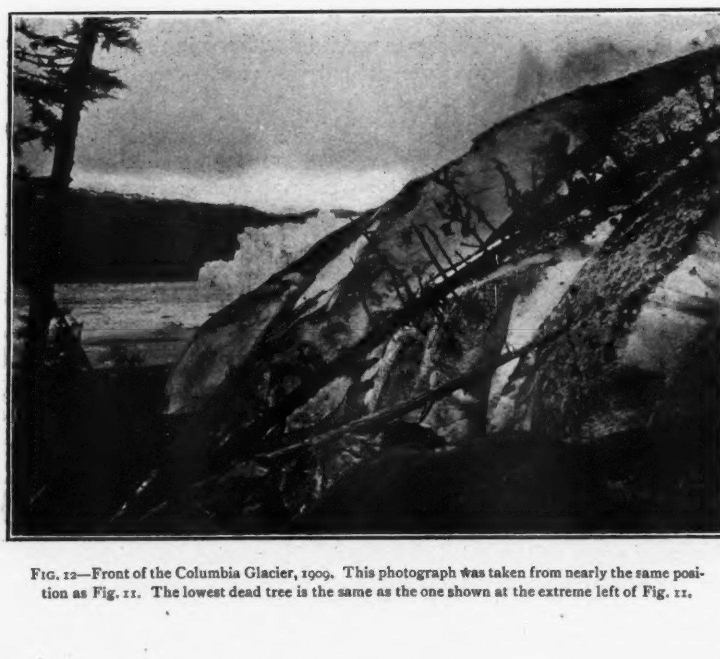


Fig. 12—Front of the Columbia Glacier, 1909. This photograph was taken from nearly the same position as Fig. 11. The lowest dead tree is the same as the one shown at the extreme left of Fig. 11.

The almost erect, dead, nearly branchless tree shown on the right in Fig. 9 has been pushed forward and can easily be recognized in Fig. 10. At the west edge of this island we found one of the most forcible visual evidences of the glacier's strength. Here the ice was literally plowing up the beach gravels into a ridge 25 feet high (Fig. 13), and such an example of titanic and silent force could not but arouse feelings of awe and of profound respect for the white giant.

FIG. 13—Push moraine 25 feet high at front of Columbia Glacier.

FIG. 14—Our launch anchored to an iceberg off the Columbia Glacier.

Meares Glacier

The Meares Glacier is situated at the head of the fiord-like northern part of Unakwik Inlet (Figs. 1, 15, and 16). We named it after Captain John Meares, one of the early explorers of Prince William Sound (1786). We know of no other information than that here noted concerning this glacier, except that Fidalgo in 1790 and probably also Vancouver in 1794 visited Unakwik Inlet and reported that the upper end was blocked by ice. They noted the noise of the falling ice, and we also observed that even to-day the

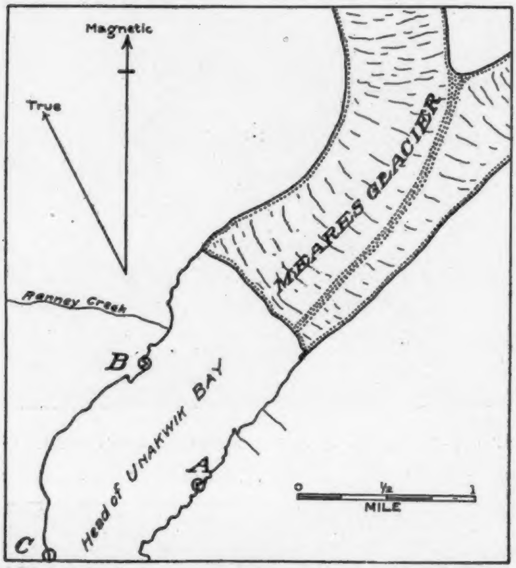


Fig. 15—Sketch map of front of Meares Glacier and vicinity, June 1909. The points marked by circles are stations from which photographs were taken.

boom of the ice breaking from the front reverberates impressively between the steep mountain walls of the bay.

In Aug., 1905, a hurried visit to the glacier was made, but the exhaustion of the supply of films prevented the securing of photographic records. On June 26th, 1909, we went up to the head of the bay and mapped and photographed the front. Fig. 16 is the view from station C of Fig. 15. The front of the glacier is four-fifths of a mile wide and at least 300 feet high. The waves caused by huge falling fragments of ice made it unsafe for us to approach closer to the ice than three-quarters of a mile in our dory.

FIG. 16—Front of the Meares Glacier, June, 1909. Photographed from Point C, Fig. 15.

In 1905 the bushes and trees were close to the ice and there was no bare zone, or at most a very narrow one, visible between the ice and the forest. In 1909 the front of the ice seemed to be a little in advance of its position of four years before. At the later date near the front of the glacier on the south side was a brown zone estimated to be 200 feet in width. This brown zone appeared to have been caused by dead vegetation rather than by bare rock, and at the edge of the ice there were a few small trees. Close to the glacier there was a sparse forest which contained trees estimated to be ten inches in diameter. Hence the ice was probably as far forward in 1909 as it has been during the last hundred years or more.

Two glaciers join about two miles back from the front to form the main body of the Meares Glacier, and a small medial moraine extends seaward from the point of junction. The ice stream from the north is the larger of the two small streams, and it probably comes from a snow-field which discharges northward also into the Yale Glacier of Port Wells. The front of the Meares glacier is a clear white wall of ice with delicate blue shadows, and although it is not as large as several other glaciers of Prince William Sound, it is, nevertheless, one of the most beautiful.

LOCATION OF THE TOWNS AND CITIES OF CENTRAL NEW YORK

BY

RALPH S. TARR

LARGER GEOGRAPHIC FEATURES. The largest geographic province in the State of New York is a hilly plateau (Fig. 1), the northern portion of the Appalachian plateau which skirts the western base of the Appalachian mountains. This plateau extends northeastward to the Hudson River, where it is known as the Catskill mountains; thence it stretches westward to the western boundary of the State and southward into Pennsylvania. To the north of the plateau, in eastern New York, rise the Adirondack mountains, with the valley of the Mohawk River forming a broad depression between the Adirondacks on the north and the plateau on the south. In central and western New York the plateau is terminated on the north by a more or less perfectly developed escarpment, beyond which, to the north, lies a plain of very level character which extends to the shores

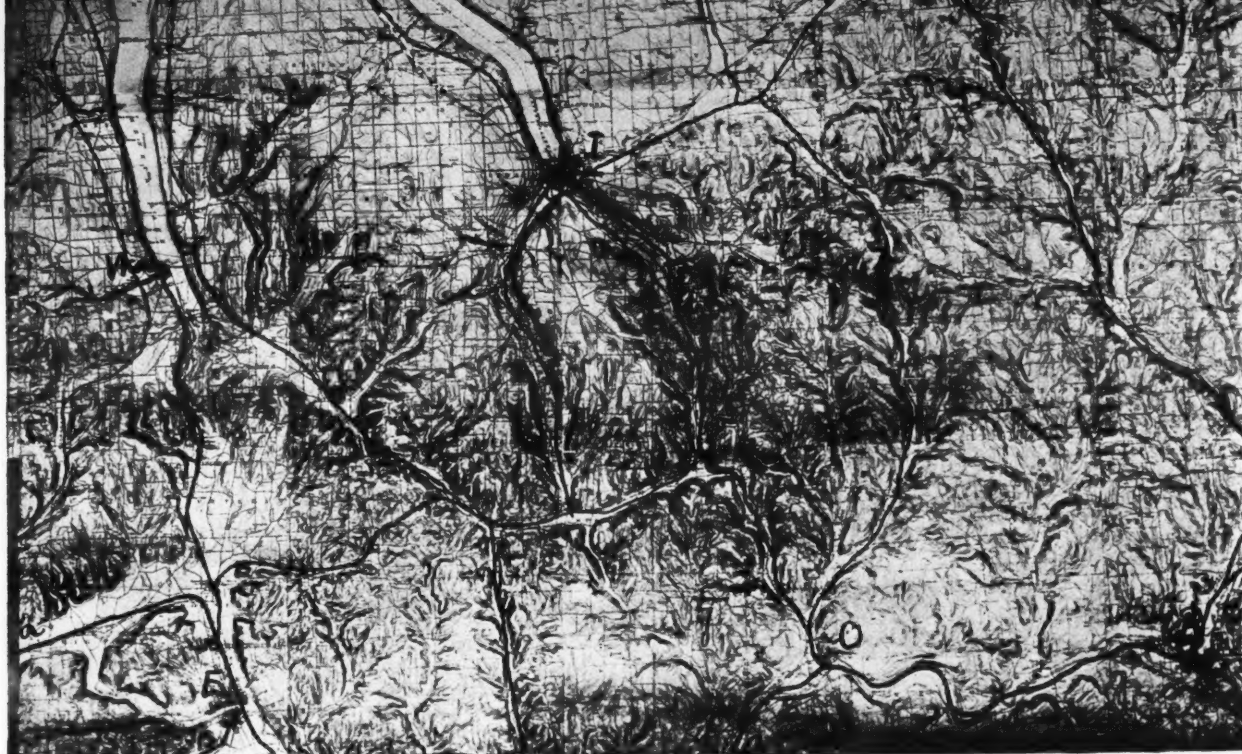
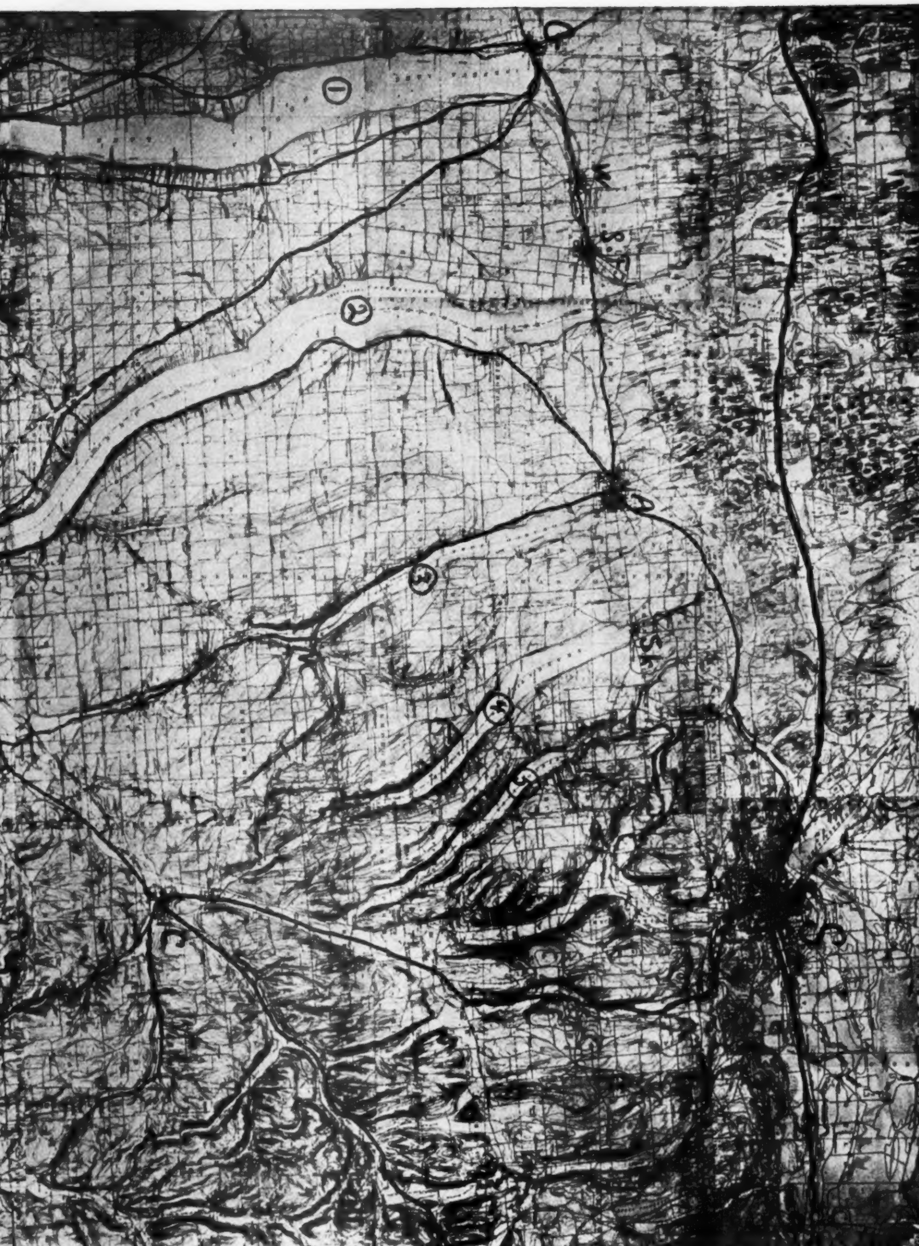


FIG. 1—Photograph of a part of the U. S. Geological Survey topographic map, showing the Finger Lake region of Central New York. The railway lines drawn in ink: a b, southern highway; c d, northern highway; B., Binghamton; O., Owego; E., Elmira; Wa., Watkins; I., Ithaca; C., Cortland; M., Moravia; G., Geneva; W., Waterloo; S. F., Seneca Falls; A., Auburn; Sk., Skeneateles; S., Syracuse; 1, Geneva Lake; 2, Cayuga Lake; 3, Owasco Lake; 4, Skeneateles Lake; 5, Otisco Lake.



of Lake Ontario. Further west is a still narrower plain between the escarpment and Lake Erie.

THE HIGHWAYS. These geographic features, and others, have had an important influence on the growth and development of the State as a whole. The fact that the Hudson valley, submerged to admit the sea, crosses the northern extension of the Appalachian mountains, has opened a highway toward the interior, which is continued westward by the Mohawk valley until the rugged plateau is crossed and the level lake plains reached. From the Canadian line to the southern tip of the Appalachians, in Alabama, there is no similar highway across the mountain and plateau barrier which lies between the seacoast and the fertile plains of the Mississippi valley.

It is well known how very important this highway toward the interior has become, first by the building of the Erie Canal, then by the construction of trunk railways. This has come to be one of the great routes of commerce in the world; and it has not merely led to the growth of the metropolis of New York on one end and Buffalo on the other, but has affected the whole State and has exercised a profound influence on the development of the country to the west. This highway will not, however, have attained its full degree of usefulness until it is possible for boats starting from Duluth and Chicago to freely pass over it and out to sea. Perhaps it will be not until the wisely planned works of the Canadians have begun to produce their inevitable economic effects on our own country that people in general will awaken to the truth of this statement; but I have faith that ultimately there will be full recognition of the fact that there is here a geographic invitation to reap great profit at relatively small expense. The invitation was early seen and accepted, in a way suitable to the times; but there has been no Governor Clinton of late.

Besides the dominant Hudson-Mohawk-Great Lakes Highway (Fig. 1, c d), there is a highway of secondary importance along the Susquehanna valley in southern New York (Fig. 1, a b). The Susquehanna is one of the few Appalachian rivers that heads in the Appalachian plateau and then flows across the entire mountain area to the Atlantic. It heads far back in the plateau, but not far enough to offer a complete passage, and in this respect is inferior in value to the Mohawk. Moreover, it empties into the sea many miles to the south of New York, and for that reason, also, it offers a much less inviting route for products from central New York than the shorter route via the Mohawk. As a route for products from the interior plains to the ports of Philadelphia or Baltimore the Susque-

hanna is distinctly inferior to other routes across the mountains further south.

For these reasons the Susquehanna route has never attained high importance; but parts of the valley across the mountains and plateau have been utilized by railways which have chosen a route across country, from New York to Buffalo, in competition with the Hudson-Mohawk route. Thus the Erie, Lehigh Valley and Lackawanna railways, crossing the mountains by winding courses with heavy grades, descend into the Susquehanna valley and then follow it for a portion of its course in their way across the plateau, each route diverging from the Susquehanna into some cross route leading toward the lake plains. Thus in New York the Susquehanna valley is a highway of some importance, but in no respect equal to the Mohawk-Hudson highway.

Inherent Resources. The three larger geographic provinces within the State whose influence affects the growth and development of the region under consideration,—the Adirondacks, the plateaus, and the lake plains—vary greatly in the amount and kind of contribution toward the growth of industrial centers. In each of the provinces there is water power of greater or less value; in each there is some mineral wealth; in each there is agriculture; and in each there is lumber; but in each the relative value of these resources varies greatly. There is most water power in the Adirondacks where it is least needed and least used; there is least in the plains where it would be most useful. There is much lumber in the Adirondacks and also a great quantity in the hilly plateau, but little on the plains. The mineral wealth includes building stones, clay, cement materials, salt and iron, besides mineral products of lesser value. The first three are widely distributed; the salt is confined to the central part, in the plateau and on its northern edge; and the greatest amount of iron comes from the Adirondacks.

The Adirondack province is the region of greatest economic poverty, for much of it is a forest-covered wilderness, the home of the lumberman, and in summer of the sportsman and the summer visitor. There is little agriculture, for most of the surface is too rugged and the soil too thin. The lake plains, with a level surface, a deep, fertile soil, and a genial climate modified by the presence of the large bodies of lake water, form an agricultural belt of great productiveness and the seat of a prosperous farming community. In the plateau country, too, there is much agriculture, but it varies greatly in kind and value from place to place. Toward the north, where the plateau surface is lower and more level, there is extensive

and profitable farming; and the larger valleys are the seats of prosperous farms. But in the upland, as a general proposition, farming is far less successful. Although there are many small areas of fertility, and individual farms quite equal in value to some of those in the valleys, in the main, the plateau region is not adapted to the highest grade of agriculture. There are extensive areas too steep for crops and others with a soil too thin for successful cultivation. Much of the area is in forest, and still more in pasture; dairying and sheep raising are prominent industries; markets are often remote and difficult to reach over bad roads and steep grades; and for several decades farming in the plateau region has been on the decline and the rural population has been decreasing.

Contributing Resources. Fortunately, this region does not have to depend upon its own inherent resources, for, being on or closely in touch with the great highways mentioned above, it easily receives resources which other sections are able to contribute out of their abundance. Of these resources none are more important than the coal from Pennsylvania. The Lackawanna and Lehigh Valley railroads cross the anthracite fields on their way between New York and Buffalo; and other roads tap the bituminous coal fields further west. In seeking an outlet for this coal, railroads reach out to the Erie Canal route and to the Great Lakes as well as to the seacoast, and those railroads wind their way across the plateau of central New York. Much of the industrial development of the valley towns of the plateau region, as well as of those along the Erie Canal, depends upon the coal thus brought to them; and the towns on the way are further influenced by the transportation facilities that the coal-carrying roads furnish. It is safe to say that there would be not only fewer but far less important railroads through the sparsely settled plateau region of central New York if the coal carrying trade had not encouraged their construction.

The dispersion of products, upon which successful manufacturing depends, is thus well provided for in the greater part of the plateau region (Fig. 1). From its own resources the plateau country could hardly have invited such extensive railway construction; but being crossed by two important highways from seacoast to interior, and having extensive coal fields on the southern side seeking outlet to the northern highway, the more important valleys are threaded by lines of railway. Since these cross lines connect on the northern end with the Great Lakes and the Mohawk-Hudson highway, they make the regions that these routes connect indirectly tributary to the needs of the valley towns of the central New York plateau.

Cross Routes. Thus, in addition to the two great highways there are numerous cross routes, or byways (Fig. 1). Like the highways, these are dependent upon physiographic conditions. In a word, they are stream-made valleys cut in the plateau and modified, in one way or another, by glacial action. Along these valleys roads and railroads have been built. To understand the nature of these cross routes calls for a brief description of the plateau region.

It is a broad area of nearly horizontal strata, with the upland rising from 1,500 to 2,000 feet above sea level. Long-continued denudation has greatly dissected the plateau, giving rise to a mature topography, with broad, deep valleys and undulating hill tops rising to a fairly uniform level. Looking across country from the crest of one of the upland hill tops, the appearance is that of a plain; but from the valleys one sees steep slopes and a hilly country; and a journey across country confirms the latter impression, for one must go up and down hill and across a succession of broad, deep valleys in any such journey (Fig. 1).

While the plateau region is a stream-dissected country in the main, it has received profound and important modification as a result of glacial action. Glacial erosion has broadened and deepened many of the valleys, especially those extending north and south in the direction of ice flow, like those occupied by the Finger Lakes. Such erosion has lowered the bottoms of some of the valleys even below sea level, and in the basins thus produced, and in part behind dams of glacial drift, long finger-like lakes have been formed.

Glacial erosion has worked laterally, as well as vertically, steepening the valley slopes here and there, often making them so precipitous that the forest alone grows upon them. The steepened slopes of the larger valleys, such as Cayuga and Seneca (Figs. 4 and 7), terminate on the upper side at a fairly uniform level at which the tributary streams enter, hanging high above the valley bottom. These *hanging valleys* have moderate grade above this level, but their water is precipitated down the steepened slope of the main valley in a series of cascades, in picturesque gorges, furnishing water power at a number of places.

Ice erosion has introduced modifications in the topography in still a third, and even more important way. As the ice swept across the divides of the preglacial streams, perched high up in the plateau, it scoured them down, thus greatly decreasing the grades from one valley to the other. In many cases the divides between streams flowing north and south were worn entirely away and the two opposing valleys united into a single *through valley* (Figs. 1, 2, 3, and 4),

graded up more or less by glacial deposit. After the glacier disappeared many streams in valleys that in preglacial time sloped northward and shed their waters into the St. Lawrence system, were now so united with south sloping valleys that the waters flowed into the Susquehanna system. In this way the headwaters of the Susquehanna have received notable accessions robbed from the St. Lawrence drainage area. The through valleys have also been straightened and widened by lateral ice erosion, cutting off the overlapping spurs.

The newly established grades of the through valleys, made by glacial erosion and deposit, have opened up many gaps across the plateau, and these the railroads follow. Had it not been for this modification of the topography by ice action we may be sure that railroad building in the plateau region would have been far more difficult than now, and many of the present railways would have been quite impossible because of the heavy grades up to divides and the need of tunnels on the way. Under present conditions the passage of the plateau is easy, especially along the through valleys at the southern ends of the valleys of the Finger Lakes.

These through valleys form the leading cross routes, or byways, between the Susquehanna and Mohawk-Great Lakes highways (Figs. 1-4). They are rendered still more important by the deep, long, narrow lakes which occupy a part of their course and are useful for navigation. The two largest of these lakes, Cayuga and Seneca, are united by canal with the Erie Canal; but at present the traffic by rail from north to south across the plateau province is of much more importance than that by water.

There are no cross routes in the plateau province in an east and west direction, because the glacier eroded only the divides between north and south flowing streams. To go by rail from Ithaca to Watkins, for example, a distance of about 20 miles in an east-west direction, one must go south, then west, then north, travelling around three sides of a quadrangle (Fig. 1). Similar roundabout journeys are necessary between most points lying on an east-west line; but railway travel north and south is much more simple and direct.

CITIES ON THE NORTHERN HIGHWAY. Along the Hudson-Mohawk-Great Lakes Highway, from New York City to Buffalo, there is a succession of villages, towns and cities closely spaced along the entire route. The importance of this transportation route is indicated most clearly by the size and growth of the two cities at its end—Buffalo, where it touches the Great Lakes, and New York City, where it touches the sea. Naturally, these are the two largest cities of the State, because of their location at the two ends

of the leading highway. Naturally, also, the cities next in size in the State are at favorable points on this same great highway.

Next in size to Buffalo is Rochester on the Erie Canal and New York Central Railway at a point where the highway is crossed by the Genesee River, which here tumbles in great falls, furnishing water power of great value. The city lies in the midst of a fertile agricultural region; it is near enough to Lake Ontario to benefit from the shipping on that large water body through its port Charlotte; and it is at the point of junction of routes from the broad and fertile upper Genesee valley with the east-west highway.

Ranking next to Rochester is Syracuse, less favorably situated and to-day profiting little from the cause which led to its foundation and early growth. Salt making is practically an industry of the past in Syracuse, though salt waters which are led from the plateau region to the south to the suburb Solway sustain a thriving industry there. Toward Syracuse from the south lead three through valleys which, uniting north of Cortland, are continued southward by a continuous through valley to Binghamton (Fig. 1). This is one of the most important north-south cross routes in central New York and it extends northward to the lake port of Oswego. The fact that Syracuse is situated at the point where this cross route intersects the great east-west highway is one of the factors in the growth of the city. The cross route unites Syracuse with the anthracite fields, as the east-west highway connects it with the sea and the Great Lakes.

Next in size among the cities of New York are Albany and Troy, both practically at the point where the Mohawk from the west unites with the Hudson from the north; and after these cities come Utica and Yonkers, the former at the head of the Mohawk, the latter just above New York City. All four of these cities lie outside the area with which this paper is immediately concerned. Many smaller cities, towns and villages lie along the highway between New York and Buffalo, all dependent upon the facilities of transportation which the highway offers, and most of them further influenced by the convergence of cross routes toward their site, or by some other favorable geographic condition.

Cities on the Southern Highway. Among the cities of New York the ones next in size to those mentioned are located on the Susquehanna-Chemung highway. These are Binghamton and Elmira (Figs. 1 and 2), to which also should be added Sayre in Pennsylvania, just across the southern boundary line of New York. Waverly in New York is practically one of the outskirts of Sayre.

FIG. 2—Photograph of a part of the U. S. Geological Survey topographic map, showing the location of Binghamton (B) and Owego (O) on the southern highway.

Each of these cities depends for its growth upon the convergence of cross routes upon the southern highway. Binghamton (Fig. 2), on the Susquehanna, is at the point where the Chenango River enters, and it is along this valley that the cross route to Syracuse runs, as well as one northeastward to Utica, and still a third, diverging from the second and rejoining the Susquehanna higher up, leading toward Albany.

Sayre lies where the Susquehanna turns southward, at the junction of the Chemung, and at the point where a through valley enters, which, branching at Van Etten, opens routes to both the Seneca and Cayuga valleys. The Lehigh Valley Railroad, coming up the Susquehanna, enters this through valley and, by easy grade, continues along the Seneca valley on its way across the plateau toward Buffalo; and a branch line diverging from it at Van Etten follows the Cayuga valley, reuniting with the main line at the lower end of Seneca lake.

The Lackawanna and Erie railways, coming down the Susquehanna from above Binghamton, enter the Chemung valley at Sayre and pass up it through Elmira (Fig. 1). Another through valley, leading southward from the Seneca valley toward Elmira, is followed by two lines of railway; another railway enters Elmira from the south, and a third, by a difficult route, over a part of the plateau, from the northeast.

The influence of the convergence of highways on the growth of centers of population in this hilly country is further illustrated by several smaller places in the Susquehanna valley, which is deeply sunk in the plateau. For example, Union lies at the mouth of Nanticoke Creek; Owego at the mouth of Owego Creek; and an examination of the U. S. Geological Survey topographic map will show still other instances.

In such a hilly country it follows, of necessity, that the chief travel and transportation must be along the valleys, and, consequently, that the points of their convergence will become centers of industry and population roughly proportionate in importance to the volume of trade carried along the routes. These points of convergence become junctions and places of transfer; and they become handlers, manufacturers and distributors of the products contributed by the converging highways. That the towns and cities at these points are no larger is due primarily to the fact that they lie in a region of limited resources, having little material to contribute for manufacture and distribution, and in a region of sparse population demanding little from abroad or from local manufactories.

That the larger centers of population along the southern highway are smaller than those along the northern highway is due partly to the fact that the surrounding country is less prosperous and productive, partly to the fact that the highway is secondary in importance as a through route, and partly to the fact that this route cannot contribute the same variety of resources from outside, at the same expense, as can be done along the northern highway. That the cities have attained even their present size is in no small degree due to the fact that they lie near to the coal fields and are reached by leading coal carrying roads.

THE CROSS ROUTE CITIES. It would be tedious to consider these routes one after the other. All the cities and most of the towns and larger villages between the northern and southern highways lie along the cross routes, and the causes for their location fall into a few categories which can easily be stated in a consideration of the two types of cross routes:—(1) the continuous through valley; (2) the through valley with a lake at one end.

Of the former the cross route from Binghamton to Syracuse may be considered as typical (Fig. 1). For the greater part of its length this route lies in a narrow valley deeply set in the plateau and bordered by steeply rising sides. The narrow floodplain is closely farmed, where not too wet; and where not too steep the valley slopes are also cultivated, though less successfully. Farms occupy the upland on either side, but the population is sparse and decreasing. A railway line joining the southern and northern highways follows this cross route.

Here and there side valleys enter, and along most of them roads descend from the upland. Groups of houses and small villages are commonly found in the main valley at such points; or, if the entering valley is large, opening up a larger area of tributary country, there may be a good-sized village. Here and there a creamery, or a grist mill may be seen manufacturing local products, and in some cases making use of water power of a stream descending swiftly from the upland, or of some low fall in the main stream itself. Occasionally there is a small manufacturing plant which depends upon the outside for both its fuel and its raw material.

At only one point in all the distance between Binghamton and Syracuse is there any notable concentration of population. This is at Cortland, which is located in the most favorable situation along the entire route (Fig. 3). In the first place, it lies about midway between Binghamton and Syracuse and is thus able to serve a large area of surrounding country that is beyond the easy reach of these

FIG. 3—Photograph of a part of the U. S. Geological Survey topographic map showing location of Cortland (C) and the railways (heavy black lines) converging on that center. M, Moravia.

two cities. But far more important than this is the fact that it is situated at the most extensive convergence of highways in the central part of the plateau region. Six valleys radiate from this center, and along five of them railways run. In consequence of its favorable situation, Cortland has grown rapidly and has become one of the leading manufacturing centers in the plateau region.

The Seneca and Cayuga cross routes may be taken as typical examples of the second class of cross routes (Figs. 1, 4, and 7). Toward each of the lakes through valleys converge from the south, connecting them with the Susquehanna highway, while the lakes themselves extend almost up to the northern highway. Two such through valleys converge toward each of the lakes, one from Owego and one from Sayre toward the Cayuga valley, and one from Sayre and one from Elmira toward the Seneca valley. Along these through valleys south of the lakes the conditions are quite like those in the cross route already described; but in the part of the route occupied by the lakes the conditions are quite different.

Lake Head Towns. There is a town at the head of each of the lakes: Ithaca at the head of Cayuga Lake and Watkins at the head of Seneca Lake (Figs. 1 and 4). Each of these owes its location to the shipping facilities on the lake, each of which, stretching northward for about 40 miles, is united with the Erie Canal by a short branch canal. Although Seneca Lake is slightly larger than Cayuga, Watkins is much smaller than Ithaca. The fact that Cornell University is at Ithaca partly accounts for the difference in size, but even aside from this there are excellent reasons of a geographic nature which encourage the growth of a larger city at the head of Cayuga Lake.

In the first place, all the people at the head of Cayuga Lake are concentrated in one city (Fig. 5), while near the head of Seneca Lake there are two centers to divide the population. Less than three miles south of Watkins is Montour Falls (Fig. 6), whose location depends, first, on water power and, secondly, on the fact that valleys from the southwest and southeast converge toward this point instead of toward Watkins. The lower steepened valley slopes are too steep here for railroads to descend to Montour Falls from the hanging valleys along which they approach the Seneca valley, but wagon roads descend at this point so that at Montour Falls an east-west route intersects the north-south cross route.

A second reason for the larger size of Ithaca is the fact that there is a much more perfect convergence of highways there (Fig. 1). To the north is the lake valley; to the south the through valley leading

to Sayre; to the southeast the through valley leading to Owego; to the northeast the through valley leading to Cortland and Syracuse, or, by a branch through valley to Auburn. Along each of these routes a railway runs. A third geographic condition favoring the greater size of Ithaca is the fact that it is on the most direct coal route from the anthracite fields to the northern highway. One of the first roads for the distribution of anthracite was built to Ithaca, whence the coal was sent by boat down the lake to the Erie Canal. The increase in the use of railroads for this purpose, and the decline in the relative usefulness of the canal, long ago diverted the coal traffic that promised to center on Ithaca; but this factor had much influence on the early growth of Ithaca and is still of some importance.

A factor seriously interfering with the growth of Ithaca is the character of the converging valleys. The one from the south, leading toward Sayre, is not a perfectly developed through valley, for its divide, though greatly lowered, was not completely erased by glacial erosion and deposit. Accordingly, there is a heavy grade between Ithaca and the divide; and on leaving Ithaca for the north the railway must again climb out of the valley, ascending the steepened slope by a heavy grade. It was the presence of these grades that led the Lehigh Valley Railway Company to adopt the Seneca route for its main double-tracked road, leaving Ithaca side-tracked on a branch line. The through valleys from the southeast and northeast approach Ithaca high above the Cayuga valley bottom and terminate as broadly open hanging valleys on the upper edge of the steepened main valley slope. This condition has seriously affected the railway approach to Ithaca. One line from the south descends the steepened valley slope to the level of Ithaca by a switchback (Fig. 5); the other keeps up in the hanging valley and, swinging off at right angles, passes on to the northeast along the other hanging valley, not descending to the town at all (Fig. 5). It is on the plateau where the hanging valleys terminate on the steepened slope that Cornell University is situated.

The influence of the approach of through valleys to the main valley, together with their termination high up above the valley bottom, from which they are separated by the steepened slope, has had an even more serious effect on Watkins than on Ithaca (Fig. 6). Thus the main line of the Lehigh Valley Railway keeps up above the edge of the steepened slope and the station for Watkins is three miles from the town; while the Fall Brook branch of the New York Central has its Watkins station a mile from the town; and in each case the station is over 500 feet above the town (Figs. 4 and 6).

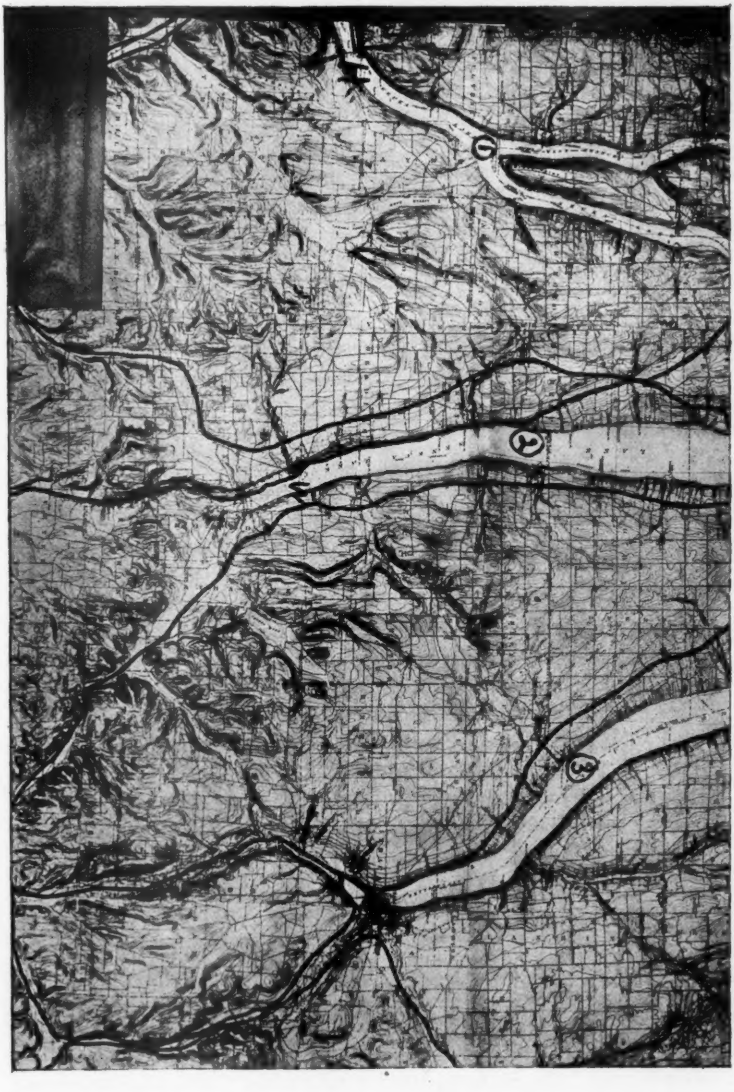


FIG. 4—Photograph of the U. S. Geological Survey topographic map, showing lake head towns, and location of Ithaca (I), Watkins (W) and Hammondsport (H). (1) Keuka Lake; (2) Seneca Lake; (3) Cayuga Lake.

Both of these lines are double-tracked railways, one tapping the anthracite, the other the bituminous coal fields; but because of the peculiar topography their influence on Watkins is very slight.

There are lake head towns at or near the heads of the other larger Finger Lakes,—Naples near the head of Canandaigua Lake, Hammondsport at the head of Keuka Lake, and Moravia near the head of Owasco Lake; but there are no towns at or near the heads of Skaneateles or Otisco lakes; doubtless, partly because these lakes are so small and partly because there is little tributary country and no convergence of valleys. Of the lake head towns only two,—Watkins and Hammondsport (Fig. 4), are exactly on the lake. Ithaca is nearly at the lake head and is connected with it by a navigable inlet, but the town is separated from the lake by a mile of delta swamp. Similar swamps separate Moravia and Naples from the lakes, and they are situated at the points nearest to the lake where there is a good town site and at the entrance of lateral routes. Moravia is at the mouth of a valley from the east (Figs. 1 and 3), and Naples at a point where valleys converge from the south, east, and west.

All of these lake-head towns are located on routes of travel of secondary importance—cross routes—and in a hilly plateau country of only moderate resources. Even where other routes converge upon them, they are minor in importance to the cross route itself, so that there is little contribution of resources either from the surrounding country or from abroad. Consequently, it could not be expected that any of these places should attain large size or great importance as industrial centers. They are, in the main, little more than distributing centers for a small area of country of no great productiveness. Geographic laws are inflexibly opposed to their growth beyond certain moderate limits. The operation of the same laws that have led to the growth of New York and Buffalo, to the smaller cities of Syracuse and Rochester, and the still smaller centers of Binghamton and Elmira, have determined for these lake-head towns and others on the cross routes of central New York an even more subordinate rank.

Lake Outlet Towns. The lower ends of the lakes have, on the whole, proved more favorable sites for towns than the upper ends (Fig. 1). There are some apparent contradictions to this statement; but the total of the lake outlet town population is far in excess of the total of the lake-head towns. There are several reasons for this. In the first place the lake outlet towns are distributing centers for products brought from all along the lakes and they thus

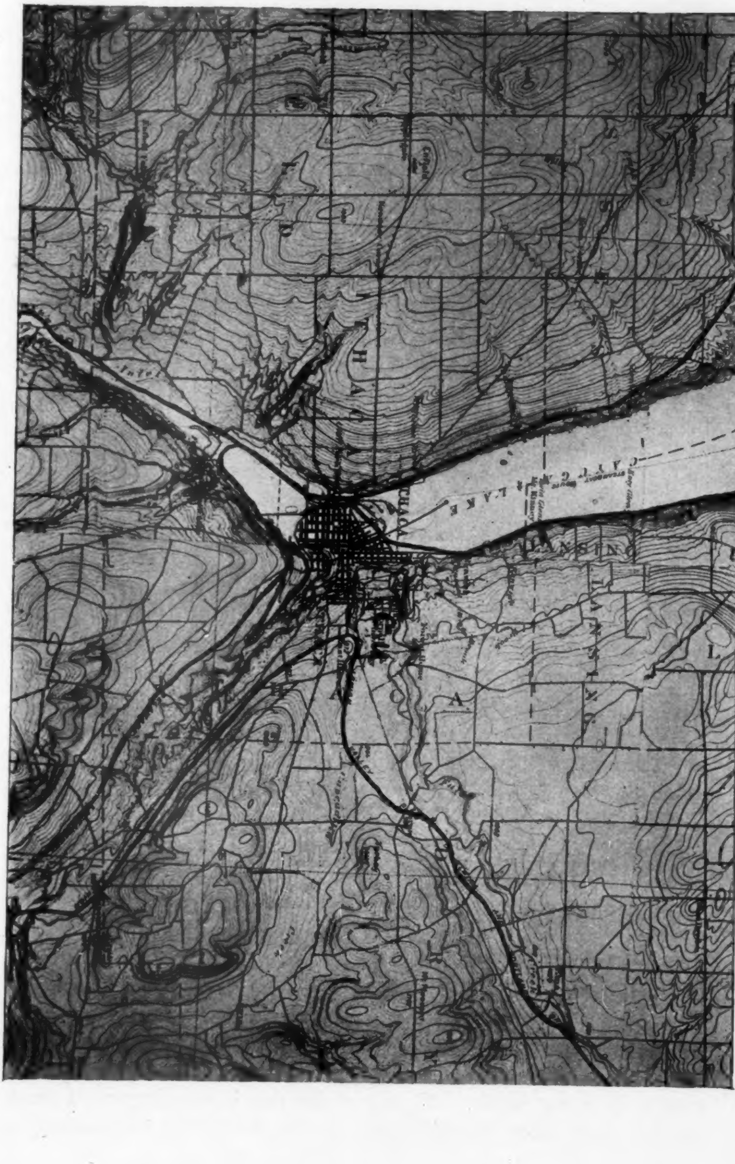


FIG. 5—Photograph of the U. S. Geological Survey topographic map to show the location of Ithaca, and the railway lines leading to it. C. U. is site of Cornell University.

have a large contributing area; secondly, they are nearer the great northern highway toward which products tend; thirdly, they are in a more open and much more fertile country than the lake-head towns which are situated in the bottoms of valleys deeply sunk in the hilly plateau; and finally, a number of the lake outlet towns have water power regulated by a large lake.

Most of the lake outlet towns are exactly on the lake or on navigable outlets close by the lake. Canandaigua is practically at the outlet of Canandaigua Lake, as is Penn Yan on Keuka Lake and Skaneateles on Skaneateles Lake. Auburn is about three miles from Owasco Lake, making use of water power from the outlet stream. The absence of a large town at the outlet of Cayuga Lake is notable, for the town of Cayuga is the smallest of all the lake outlet towns, while Ithaca at the head of Cayuga Lake is the largest of all the lake-head towns. The absence of a large town at the lower end of Cayuga Lake is due to several facts, as follows:—(1) the presnce of a very extensive area of swamp there; (2) the near presence of large towns serving the needs of the surrounding region; and (3) the development of Seneca Falls, three miles west of the head of Cayuga Lake, on the site of a fall in the outlet of Seneca Lake.

The lake outlet towns fall into a fairly straight line, and this fact (Fig. 1), together with the cause for it, has had not a little influence on their growth. From Syracuse westward the great northern highway extends as an open and easily traversed route; but from Syracuse southwestward there are two barriers to free travel: (1) the hilly plateau, (2) the long Finger Lakes. Routes to the southwest therefore, follow the northern edge of the plateau and swing around the lake heads. This makes the lake-head towns the crossing points of north-south cross routes and an east-west route diverging from the northern highway. The towns along this diverging route—Marcellus, Skaneateles, Auburn, Owego, Seneca Falls, Waterloo, Geneva and Canandaigua—exceed in population the combined population of the towns on the northern highway between Syracuse and Rochester. The growth of these lake-head towns so near the northern highway has doubtless had the effect of diminishing the growth and prosperity of the towns along the Erie Canal between Syracuse and Rochester.

THE LAKE SHORES. The shores of the lakes are remarkably barren of towns (Figs. 1, 4, and 7). Throughout most of their extent there are none. One reason for this is the absence of sites, for the valley sides descend steeply to the lake, often terminating in

FIG. 6—Photograph of the U. S. Geological Survey topographic map to show the location of Watkins (W), Montour Falls (M. F.), Burdett (B), and Odessa (O).

a shale cliff faced by a narrow gravel beach. A second reason is the fact that, in general, the side valleys converging upon the main lake valley are short and, therefore, serving only a small tributary country. Moreover, these lateral valleys usually terminate as hanging valleys several hundred feet above the lake level, being extended to the lake by narrow, steep-walled gorges, occupied by a succession of cascades and waterfalls.

Here and there the streams have built deltas out into the lakes, and these are in many cases seized upon as the sites of hotels and summer cottages, or even, in some cases, as a small village center. In one or two places, as at the mouth of Salmon Creek on the east side of Cayuga Lake, the deltas have been utilized as the sites of salt plants; and at one or two places, as at Dresden on the west side of Seneca Lake, the entrance of a valley—the outlet of Keuka Lake—which can be traversed by roads and which opens up a fairly large tributary country, has led to the development of a town of some importance. Toward the north, where the lake valley walls become less steep, so that town sites on the lake shore are possible, there is more settlement and there are even some villages. This condition finds its best illustration on the east side of Cayuga Lake, where Aurora, Levanna and Union Springs are located.

In general, though, the lake shores are free from centers of population between the lake head and lake outlet. Towns and villages are much fewer and smaller along these parts of the cross routes than along any other portions of either these particular cross routes, or of others in the plateau region of central New York. Indeed, except at the lake heads and lake outlets, there is not a single large town or city in the hundreds of miles of lake shore line. A single geographic factor, water transportation, invites centers of population, and one might at first be surprised at their absence; but other geographic influences either oppose or prohibit such centers.

Gorge Head Towns. The absence of centers of population along the lake shores is related to another phenomenon. The lake shores themselves are not natural highways, for along most of the lake shores there are only narrow gravel beaches backed either by a wave cut cliff or by a steeply rising hillside. The hillslope above the wave cut cliff is also unfavorable for a highway, because of the fact that the steepened valley slope is gashed by numerous gorges cut in the shale by the streams descending the steepened slope from the hanging and other upland valleys (Figs. 4, 6 and 7). There are scores of such gorges on either side of Cayuga and Seneca Lakes; and in the other of the Finger Lake valleys similar conditions exist, though in much less pronounced manner.

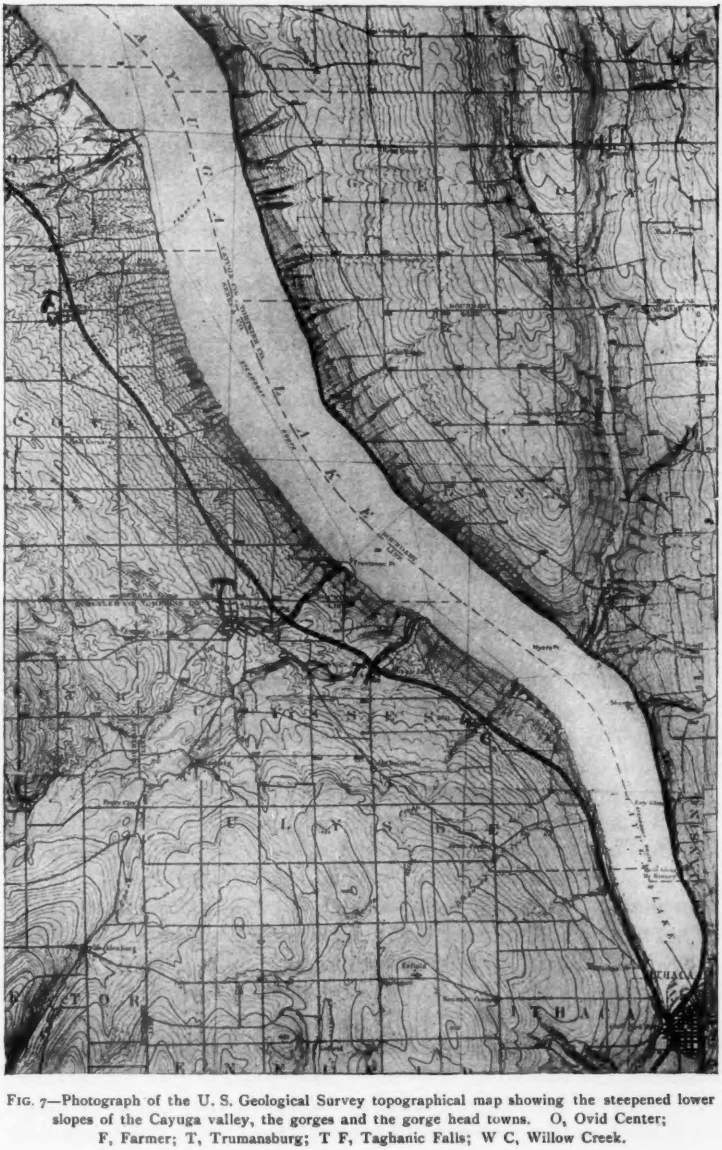


FIG. 7—Photograph of the U. S. Geological Survey topographical map showing the steepened lower slopes of the Cayuga valley, the gorges and the gorge head towns. O, Ovid Center; F, Farmer; T, Trumansburg; T F, Taghanic Falls; W C, Willow Creek.

For free travel north and south along the shores of these lakes, especially the two larger, it is necessary to go back some distance from the lake, above the edge of the steepened slope, in order to pass around the gorge heads and thus avoid the necessity of expensive bridges. Roads have been more influenced by this condition than railroads, though they, too, show evidence of its influence. The influence of the steepened slope and the associated gorges is best illustrated on the west side of Cayuga Lake, where both the roads and the railway are deflected by the topographic conditions. The roads were first deflected and centers of population have developed at points along them where other geographic conditions favored, as for instance, the entrance of a side valley, or the presence of water power, or the convergence of roads. Thus, at a distance of from one to three miles back from the lake one finds a succession of villages either at gorge heads or along the highway which extends above the gorge heads (Fig. 7). Here are found Newfield, Enfield Falls, Willow Creek, Taghanic Falls, Trumansburg, Covert, Farmer, Ovid Center and other villages, while to the eastward as far as the lake shore, and westward to the gorge head towns of Seneca valley there are no centers of population of equal size.

The east side of Cayuga Lake and both sides of Seneca Lake illustrate the same geographic influence (Fig. 4), but it is not necessary to specify the villages involved, for a glance at a topographic map will show the chain of villages whose location has been thus determined. That the roads are more under this influence than the railroads finds clear proof on the east side of Seneca Lake (Fig. 6), for here the gorge head towns of Burdett and Hector are below the railway, while Lodi and Ovid are above the railway; but all are on the main wagon road.

Effect of Convergence of Routes. In this region, as elsewhere, the question of highways is fundamental in influencing the location and growth of centers of population. While there are cases where towns have grown up on a single highway, by far the greatest number are situated at points where two or more routes converge. This has been illustrated again and again by the towns described above,—for example, Binghamton (Fig. 2), Sayre, Elmira (Fig. 1), Ithaca (Fig. 5), Cortland (Fig. 3), Rochester, and, in fact, almost all the others mentioned in the preceding pages.

Besides these illustrations of the influence of convergent routes, one can find scores of illustrations among the smaller villages and even among the crossroad hamlets. Mecklenburg, Lisle, Spencer, Van Etten and a multitude of other places illustrate this influence

among the smaller towns, some of them on the cross routes, some away from them, but almost all in valleys. The influence of convergent routes is much more noticeable in this hilly country than it would be in a more level region; and it becomes more and more noticeable in the more hilly parts of the plateau, for here the topography has increasing influence in directing the roads. The effect of the convergence on the size and growth of the towns has evidently been proportional to:—(1) the number of converging routes, (2) the extent of contributing country thus centered at the point of convergence, and (3) the facilities of transportation over the various routes. With the convergence of more than two highways, connecting with a wide area of country, and offering railroad transportation, good-sized towns and cities have developed, as at Binghamton and Cortland; but with convergence of wagon roads alone, and the bringing of a limited area tributary to the point of convergence, only small villages like Richford and Mecklenburg have been possible.

The influence of convergence of routes may be traced down to the very smallest centers, and even in the more remote parts of the upland. For example, the village of Virgil, at an elevation of 1,420 feet, is located at a point where roads following upland valleys converge, and it may be taken as a type of scores of similar upland villages and hamlets. While these are usually in the valleys, there are some cases where the hamlets are on the upland itself, as at North Barton at an elevation of 1,580 feet. In such locations, however, the centers are merely four-corners, with a half dozen or a dozen houses, a church and a school-house. This is, however, an illustration of the influence of convergence of routes, just as certainly as in the cities mentioned; but the routes open up a limited area of sparsely settled contributing country of little productivity, and the facilities of transportation are of the poorest—hilly roads, snow-covered in winter and deep in mud during spring and fall.

Many and probably most of the points where there is a distinct convergence of easily travelled routes received their first impulse of growth in the early days of stage-coach travel. Some of these points have increased greatly in size and importance under the influence of the railroad; but others, now side-tracked, have either shown no marked growth or have actually declined. Stage routes did not necessarily follow the graded valleys which the railroads now occupy; and since their object was the carrying of passengers and small packages rather than freight, they often sought different directions. For example, one of the principal stage routes in central New York

was the Catskill turnpike, running up hill and down in a general southeast direction. It crossed the through valleys here and there, as at Lisle, Richford and Ithaca, but it did not follow them as the railroads do. In the days of the stage-coach this was a busy thoroughfare,—for the time; but now the arteries of trade cross it at right angles, and it has little more importance than the other roads between small settlements. Signs of the former importance of this highway are evident every here and there; but nowhere more clearly than at Sullivanville, a few miles north of Elmira. This is a veritable deserted village, with its fine large hostelries all closed and in a sad state of decay.

Influence of Mineral Resources. The central New York plateau is not rich in mineral resources and, therefore, there is little direct influence of mineral wealth; but all the region is greatly influenced by the neighborhood of coal in Pennsylvania and by the facilities for transportation of other mineral substances from outside.

Syracuse is the best instance of the direct effect of mineral deposits on the growth of the towns of this section. Salt springs led to its location; a thriving salt manufacturing industry followed, and some is still carried on; and the introduction of salt water from the south has given the basis for the industry of soda-making at Solway, a suburb of Syracuse. Salt is also obtained at several other points from the extensive bed that underlies the plateau of central New York; for instance, there are two salt-making plants at Ithaca and another a few miles farther north, while there are also several in the Seneca valley at and near Watkins. These works have had only minor influence in the growth of the towns.

There are clay workings at a few points, giving support to small centers of population, as at Nina, south of Ithaca; stone quarries, as at Farley's, on the east shore of Cayuga Lake; gypsum quarries at several points, and cement works at Portland, north of Ithaca. To these mineral industries, dealing with heavy imperishable commodities, the facilties of water transportation along the Finger Lakes and the Erie Canal have been of the greatest importance; but neither of the industries has of itself led to the growth of large centers of population.

There are some spring waters of repute which have led to or aided in the growth of several small centers, as at Slaterville Springs, Watkins and Clifton Springs, the former a summer resort of some note, the two latter the seats of well-known Sanitaria. On the whole, therefore, the influence of mineral resources on the location

and growth of towns in central New York has been of only very slight importance.

The Influence of Water Power. The finest power in this part of the State is at the falls of the Genesee at Rochester, and this power has been of basal importance in the location and growth of Rochester. Some of the lake outlets also furnish power, though others are sluggish. This is true, for instance, of the largest outlet of all, Seneca River, which carries the combined waters of Cayuga and Seneca Rivers in sluggish course over an extensive area of swamp land. This is most unfortunate, since there is here a large body of water regulated in the huge reservoirs of the two largest of the Finger Lakes.

Skaneateles outlet furnishes power to villages along its course, as at Skaneateles Falls; Owasco outlet furnishes power to Auburn; Seneca outlet to Seneca Falls (Fig. 1); and other power of minor importance is supplied at other points by the lake outlet streams. Further west the Portage Falls of the Genesee are valuable for their water power.

Along the steepened slopes of the north-south valleys there are a multitude of waterfalls, especially in the southern half of the Seneca and Cayuga valleys. Some of these had early influence in the location and growth of towns, as at Montour Falls and Ithaca; but their present influence is of little value. All the streams are short, and their volume is variable, having been rendered even more so by the stripping off of the forest from the upland. Even the largest of these streams often run nearly dry in summer; and in winter their volume shrinks by freezing. They are, therefore, most unreliable as sources of power, even with the aid of such small reservoirs as have been built to store the waters for use in times of drought.

At certain seasons, and often for weeks at a time, there is an enormous amount of water power going to waste in the gorges that gash these ice-steepened valley walls. If the storage battery ever becomes perfected, there is here an asset of great value; and, even without it, there are opportunities for the development of large quantities of regulated power by the building of extensive storage reservoirs. That this will ever be done in a region of such limited resources can hardly be predicted with safety. Possibly, for all time the hundreds of streams with fluctuating water power will be allowed to run to waste as now.

Details of Location. Besides the general geographic factors determining the location of towns and cities in the central New

York region, there are minor geographic influences that have led to the determination of the exact sites of towns. For example, where one or more hanging valleys open out at the upper limit of the steepened slope of the main valley there are often small plateaus well above the main valley bottom, and separated from it by a steep valley side on which a town site would not normally develop. This condition is best illustrated by the site of Cornell University, which occupies such a hanging valley plateau over 400 feet above the main valley bottom (Fig. 5). There is here a fairly level site and here are situated the University buildings, together with a large number of residences, making a small town. Below, in the valley bottom is Ithaca, with four hundred feet of steep hillside between. Naturally, under the peculiar conditions existing here, with an important institution above, and the business center below, the adverse geographic conditions of a steep hillside have been in part ignored; streets are run up the steep slope and house lots have been established by grading. Thus the University site and town site are connected by a continuous series of hillside houses along a portion of the steepened valley slope. It is the only case in the plateau of central New York where a section of the steepened valley side has been chosen as the home site for a large number of people.

Elsewhere in the Cayuga and Seneca valleys there are instances of villages built at the outer edge of the hanging valleys, and these are, naturally, also gorge-head towns. Of these Trumansburg in the Cayuga valley (Fig. 7), and Odessa, Burdett (Fig. 6), and Dundee in the Seneca valley may be taken as illustrations.

Another type of village site on the valley slopes is that furnished by the hanging deltas that were built in the lake waters when a glacier dam across the northern part of the Cayuga and Seneca valleys caused the lake waters to rise high above their present level. These sites are often used for the location of single houses or small groups of houses, as at Ithaca near the University campus; and in at least one case, North Hector in the Seneca valley, one of these deltas is the site of a small village. A part of Trumansburg is also built on such a hanging delta.

Alluvial fans are favorite sites for valley towns and villages. This is due to three causes:—(1) the fact that the valley bottoms are often level and damp; (2) the fact that the alluvial fans are built up at the points where lateral streams enter the main valley, and are therefore at the convergence of highways; and (3) the fact that the alluvial fans are slightly elevated, are built of gravel through which water easily percolates, and have slopes down which

the surface water easily runs,—all factors aiding in making dry sites for houses.

Scores of instances of towns and villages on alluvial fans are found in the plateau region. In some cases the influence of the fan in determining the town site is very noticeable. For example, Watkins and Ithaca are both located on a swampy delta at the lake head, and in general, without artificial drainage or extensive filling, these deltas are uninhabitable near the lakes. The alluvial fans of Six Mile, Cascadilla and Fall Creeks have built up a part of the delta on the east side of the Cayuga valley near the lake head, so that a portion of the delta surface is no longer swampy; and Glen Creek at Watkins has made a similar alluvial fan on the west side of Seneca Lake head. These dry sites have become town sites in the midst of swamp land.

Outwash gravel plains built during the recession of the continental glacier, being well drained, have served as excellent town sites in many of the valleys. Horseheads, Elmira, Spencer, Candor, and Owego are illustrations of this class of town site.

SUMMARY. Summarizing briefly the underlying principles which have determined the location and growth of the towns and cities of central New York, it is clear, in the first place, that the question of highways is the point of primary and basal importance. The principal towns are on the leading highway in the north; and the towns next in size are on the secondary highway in the south. The other towns of the region are on byways and cross routes between the two main highways. The small size and limited growth of the latter are due mainly to the following geographical conditions:—(1) they are on byways; (2) they are in the midst of a rugged, dissected plateau, offering obstacles to easy travel by rail or road, except along a limited number of routes; (3) the plateau, a region of hilly upland with prevailingly thin, stony, infertile soil, is a region of limited agricultural resources with a diminishing population; (4) there is little water power; and (5) there is a general lack of important mineral resources.

The invasion by the continental glacier has unfavorably influenced the region: (1) by making many steep slopes where the valley sides were moderately sloping before the Glacial Period; (2) by sweeping off the soil of residual decay and leaving glacial soil in its place—though in places this was, doubtless, an advantage rather than a disadvantage; (3) by interfering with drainage, flooding some lands, giving rise to gorges, and altering stream directions. On the other hand, the glacial invasion has been a benefit to the

region in some directions, notably in giving rise to water power in some places, in bringing about conditions which have made lake navigation possible, and finally, by causing the through valleys. This latter work of the glacier is of great significance, and probably counterbalances all the disadvantages. The through valleys have guided the course of railways, some of them trunk lines, along the cross valleys; and where the through valleys converge, towns and cities have naturally grown.

Altogether, the central New York plateau region illustrates perfectly the relation between man and his environment. Geographic conditions unfavorable to many forms of agriculture have led to a change in the industry and a decline in the farming population; they have been adverse to mining and manufacturing; and they have been unfavorable to the growth of large centers of population. The location of these centers, as well as their growth, has been guided by geographic conditions, and the influence of those conditions may be traced in various directions, even in minute detail; but, in the main, the growth of towns and cities has been dependent primarily upon the routes of travel, which are dependent directly upon the topography.

GEOGRAPHY AND SOME OF ITS PRESENT NEEDS*

Geographical Progress in the Last Decade

Among the many geographical results of work in the past decade a few may be mentioned. The measurement of new and the remeasurement of old arcs will give us better data for determining the size and shape of the Earth. Surveys of all kinds, from the simple route sketches of the traveler to the elaborate cadastral surveys of some of the more populous and settled regions have so extended our knowledge of the surface features of the Earth that a map on the scale of 1:1,000,000 is not merely planned, but actually partly executed. Such surveys and such maps are the indispensable basis of our science.

The progress of oceanography has also been great. The sound-

*** This article presents most of the opening address of A. J. Herbertson, M.A., Ph.D., Professor of Geography at the University of Oxford, delivered as President of Section E, Geography, at the recent meeting of the British Association for the Advancement of Science. The paper is printed in full in *Nature*, Sept. 22, 1910.**

ings of our own and other Admiralties, of scientific oceanographical expeditions, and those made for the purpose of laying cables, have given us much more detailed knowledge of the irregularities of the ocean floor. An international map of oceanic contours, due to the inspiration and munificence of the Prince of Oceanographers and of Monaco, has been issued during the decade, and so much new material has accumulated that it is now being revised. A comparison of the old and new editions of Krümmel's "Ozeanographie" shows us the immense advances in this subject.

Great progress has been made on the geographical side of meteorology and climate. The importance of this knowledge for tropical agriculture and hygiene has led to an increase of meteorological stations all over the hot belt—the results of which will be of value to the geographer. Mr. Bartholomew's "Atlas of Meteorology" appeared at the beginning, and Sir John Eliot's "Meteorological Atlas of India" at the end, of the decade. Dr. Hann's "Lehrbuch" and the new edition of his "Climatology," Messrs. Hildebrandsson and Teisserenc de Bort's great work, and the recent studies of the Upper Atmosphere, are among the landmarks of progress. The record is marred only by the closing of Ben Nevis Observatory at the moment when its work would have been most necessary. To appreciate the progress of climatology it is only necessary to compare the present number and distribution of meteorological stations with those given in Bartholomew's Atlas of 1899. I have not time to recapitulate the innumerable studies of geographical value issued by many meteorological services, observatories, and observers—public and private—but I may direct attention to the improved weather maps and to the excellent pilot charts of the North Atlantic and of the Indian Ocean published monthly by our Meteorological Office.

Lake studies have also been a feature of this decade, and none is so complete or so valuable as the Scottish Lakes Survey—a work of national importance, undertaken by private enthusiasm and generosity. We have to congratulate Sir John Murray and Mr. Pullar on the completion of a great work.

In Geology, I might note that we now possess a map of Europe on a scale of 1:1,500,000 prepared by international cooperation, and also one of North America on a smaller scale; both invaluable to the geographer. The thanks and congratulations of all geographers are due to Prof. Suess on the conclusion of his classical work on the Face of the Earth, the first comprehensive study of the main divisions and characteristics of its skeleton.

A new movement, inspired mainly by Prof. Flahault in France,

Prof. Geddes in this country, Profs. Engler, Drude, and Schimper in Germany, has arisen among botanists, and at last we have some modern botanical geography which is really valuable to the geographer. I wish we could report similar progress in zoological geography, but that, I trust, will come in the next decade.

The Need for Classification and Notation in Geomorphology, etc.

I should like to say a few words about the subdivisions of geography and the vexed question of terminology.

In the scheme of the Universe it is possible to consider the Earth as a unit, with its own constitution and history. It has an individuality of its own, though for the astronomer it is only one example of a particular type of heavenly bodies. As geographers, we take it as our unit individual in the same way that an anatomist takes a man. We see that it is composed of different parts, and we try to discover what these are, of what they are composed, what their function is, what has been their history.

One fundamental division is into land, water, and air. Each has its forms and its movements. The forms are more obvious and persistent in the land. They are least so in the atmosphere, though forms exist—some of which are at times made visible by clouds, and many can be clearly discerned on isobaric charts. The land is the temporarily permanent; the water and atmosphere the persistently mobile, the latter more so than the former. The stable forms of the land help to control the distribution and movements of the waters, and to a less extent those of the atmosphere. How great the influence of the distribution of land and water is on the atmosphere may be seen in the monsoon region of eastern Asia.

The study of the land, the ocean, and the atmosphere has resulted in the growth of special branches of knowledge—Geomorphology, Oceanography, and Climatology. Each is indispensable to the geographer, each forms an essential part of the geographical whole. Much research work is and will be carried on in each by geographers who find their geographical studies hampered for the lack of it. As geographical progress is to a considerable extent conditioned by progress in these subjects, it would be legitimate to examine their needs. Time, however, will admit only a note on one of the barriers to progress in geomorphology—the lack of a good classification and notation.

Geomorphology deals with the forms of the land and their shaping. Three things have to be kept clearly in view: (1) The struc-

ture, including the composition, of the more permanent substance of the form; (2) the forces which are modifying it; and (3) the phase in the cycle of forms characteristic of such structure acted on by such forces. We may say that any form is a function of structure, process, and time. The matter is even more complicated, for we have instances, *e. g.*, in antecedent drainage systems, of the conditions of a previous cycle affecting a subsequent one—a kind of heredity of forms which cannot be neglected.

The geomorphologist is seeking for a genetic classification of forms and in the works of Bertrand, Davis, de la Noë and de Margerie, Penck, Richthofen, Suess, and Supan and their pupils are being accumulated the materials for a more complete and systematic classification of forms. As you all know, the question of terms for the manifold land-forms is a difficult one, and apt to engender much more controversy than the analysis of the forms themselves. I believe that we shall find it advantageous to adopt some notation analogous to that of the chemists. I have not yet had time to work such a notation out in detail, but it might take the form of using different symbols for the three factors noted above—say, letters for different kinds of structure, Arabic figures for processes and Roman figures for the stage of a cycle the form has reached.

Take a very simple set of structures and indicate each by a letter:

			UNDISTURBED	FAULTED
Structure	homogeneous		A	A′
	layered	horizontal	B	B′
		tilted	C	C′
		folded	D	D′
	mixed		E	E′

If pervious or impervious, a *p* or an *i* could be added—*e. g.* a tilted limestone with faults would be C′*p*.

Next, indicate the commoner erosion processes by Arabic numerals:

Process	moving water	1
	ice	2
	wind	3
	sea	4

One process may have followed another, *e. g.* where a long period of ice erosion has been followed by water erosion we might write 2.1, where these alternate annually, say 21.

The phase of the cycle might be denoted by Roman figures. A scale of V might be adopted, and I, III, and V used for youthful,

middle-aged, and old-aged, as this has been called, or early, middle, and late phases, as I prefer to term them. II and IV would denote intermediate phases.

A scarped limestone ridge in a relatively mature phase like the Cotswolds would be, if we put the process first, 1 C1 III.; a highland like the Southern Uplands of Scotland would be denoted by the formula 1.2.1 E1 III.

This is the roughest suggestion, but it shows how we could label our cases of notes and pigeon-hole our types of forms—and prevent for the present undue quarrelling over terms.* No doubt there would be many discussions, for example, about the exact phase of the cycle, whether ice, in addition to water, has been an agent in shaping this or that form, and so on. But, after all, these discussions would be more profitable than quarrels as to which descriptive term, or place-name, or local usage should be adopted to distinguish it.

The use of such notations in geographical problems is not unknown. They were employed by Köppen in his classification of climate; and now, in the case of climatology, there is coming to be a general consensus of opinion as to what are the chief natural divisions, and the use of figures and letters to indicate them has been followed by several other authors. This should also be attempted for oceanography.

If any international agreement of symbols and colors could be come to for such things it would be a great gain, and I hope to bring this matter before the next International Geographical Congress.

The Need for Selecting Natural Geographical Units

We have still to come to Geography proper, which considers land, water, and air, not merely separately but as associated together. What are the units smaller than the whole Earth with which our science has to deal?

When we fix our attention on parts of the Earth and ask what is a natural unit, we are hampered by preconceptions. We recognize species, or genera, families, or races as units—but they are abstract rather than concrete units. The reason for considering them as units is that they represent a historical continuity. They have not an actual physical continuity such as the component parts of an individual have. Concrete physical continuity in the present is what

* What I wish to make clear is that it is not necessary to invent a new term for every new variety of land form as soon as it is recognized. It will suffice at first to be able to label it. The notation will also stimulate the search for and recognition of new varieties.

differentiates the geographical unit. Speaking for myself, I should say that every visible concrete natural unit on the Earth's surface consisting of more than one organic individual is a geographical unit. It is a common difficulty not to be able to see the wood for the trees; it is still more difficult to recognize that the wood consists of more than trees, that it is a complex of trees and other vegetation, fixed to a definite part of the solid earth and bathed in air. We may speak of a town or State as composed of people, but a complete conception of either must include the spacial connections which unite its parts. A town is not merely an association of individuals, nor is it simply a piece of land covered with streets and buildings; it is a combination of both.

It is true that in determining the greater geographical units, man need not be taken into account. We are too much influenced by the mobility of man, by his power to pass from one region to another, and we are apt to forget that his influence on his environment is negligible except when we are dealing with relatively small units. The geographer will not neglect man; he will merely be careful to prevent himself from being unduly influenced by the human factor in selecting his major units.

Some geographers and many geologists have suggested that land forms alone need be taken into account in determining these larger geographical units. Every different recognizable land form is undoubtedly a geographical unit. A vast lowland, such as that which lies to the east of the Rocky Mountains, is undoubtedly a geographical unit of great importance, but its geographical subdivisions are not necessarily orographical. The shores of the Gulf of Mexico could not be considered as geographically similar to those of the Arctic Ocean, even if they were morphologically homologous. The lowlands of the polar regions are very different from those at or near the tropics. The rhythm of their life is different, and this difference is revealed in the differences of vegetation.

I wish to lay great stress on the significance of vegetation to the geographer for the purposes of regional classification. I do not wish to employ a biological terminology nor to raise false analogies between the individual organism and the larger units of which it is a part, but I think we should do well to consider what may be called the life or movement going on in our units as well as their form. We must consider the seasonal changes of its atmospheric and of its water movements, as well as the parts of the Earth's crust which they move over and even slightly modify. For this purpose a study of climatic regions is as necessary as a study of morphological

regions, and the best guides to the climatic regions are the vegetation ones.

By vegetation I mean not the flora, the historically related elements, but the vegetable coating, the space-related elements. Vegetation in this sense is a geographical phenomenon of fundamental importance. It indicates quality—quality of atmosphere and quality of soil. It is a visible synthesis of the climatic and edaphic elements. Hence the vast lowlands of relatively uniform land features are properly divided into regions according to vegetation—tundra, pine forest, deciduous forest, warm evergreen forest, steppe, and scrub. Such differences of vegetation are full of significance even in mountainous areas.

The search after geographical unity—after general features common to recognizable divisions of the Earth's surface, the analysis of these, their classification into types, the comparisons between different examples of the types—seem to me among the first duties of a geographer. Two sets of studies and maps are essential—topographical and vegetational—the first dealing with the superficial topography and its surface irregularities, the latter relating to the quality of climate and soil.

Much has been said in recent years—more particularly from this Presidential chair—on the need for trustworthy topographical maps. Without such maps no others can be made. But when they are being made it would be very easy to have a general vegetational map compiled. Such maps are even more fundamental than geological maps, and they can be constructed more rapidly and cheaply. Every settled country, and more particularly every partially settled country, will find them invaluable if there is to be any intelligent and systematic utilization of the products of the country. Possessing both sets of maps, the geographer can proceed with his task.

This task, I am assuming, is to study environments, to examine the forms and qualities of the Earth's surface, and to recognize, define, and classify the different kinds of natural units into which it can be divided. For these we have not as yet even names. It may seem absurd that there should be this want of terms in a subject which is associated in the minds of most people with a superfluity of names. I have elsewhere suggested the use of the terms major natural region, natural region, district, and locality to represent different grades of geographical units, and have also attempted to map the seventy or eighty major natural regions into which the Earth's surface is divided and to classify them into about twenty types. These tentative divisions will necessarily become more ac-

curate as research proceeds, and the minor natural regions into which each major natural region should be divided will be definitely recognized, described, and classified. Before this can be done, however, the study of geomorphology and of plant formations must be carried far beyond the present limits.

The value of systematic and exhaustive studies of environment such as those I suggest can hardly be exaggerated. Without them all attempts to estimate the significance of the environment must be superficial guesswork. No doubt it is possible to exaggerate the importance of the environmental factor, but it is equally possible to undervalue it. The truly scientific plan is to analyze and to evaluate it. Problems of the history of human development, as well as those of the future of human settlements, cannot be solved without this. For the biologist, the historian, the economist, the statesman, this work should be carried out as soon and as thoroughly as is possible in the present state of our knowledge.

A beginning of systematic geographical studies has also been made at the opposite end of the scale in local geographical monographs. Dr. H. R. Mill, one of the pioneers of geography in this country and one of my most distinguished predecessors in this chair, has given us in his study of south-west Sussex an admirable example of the geographical monograph proper, which takes into account the whole of the geographical factors involved. He has employed quantitative methods so far as these could be applied, and in doing so has made a great step in advance. Quantitative determinations are at least as essential in geographical research as the consideration of the time factor. At Oxford we are continuing Dr. Mill's work. We require our diploma students to select some district shown on a sheet of this map for detailed study by means of map measurements, an examination of statistics and literature which throw light on the geographical conditions, and, above all, by field work in the selected district. Every year we are accumulating more of these district monographs, which ought, in their turn, to be used for compiling regional monographs dealing with the larger natural areas. In recent years excellent examples of such regional monographs have come from France and from Germany.

The geomorphologist and the sociologist have also busied themselves with particular aspects of selected localities. Prof. W. M. Davis, of Harvard, has published geomorphological monographs which are invaluable as models of what such work should be. In a number of cases he has passed beyond mere morphology and has directed attention to the organic responses associated with each land

form. Some of the monographs published under the supervision of the late Prof. Ratzel, of Leipzig, bring out very clearly the relation between organic and inorganic distributions, and some of the monographs of the Le Play school incidentally do the same.

The Double Character of Geographical Research

To carry on geographical research, whether on the larger or the smaller units, there is at present a double need—in the first place, of collecting new information, and, in the second place, of working up the material which is continually being accumulated.

The Need for the Systematic Collection of Data

The first task—that of collecting new information—is no small one. In many cases it must be undertaken on a scale that can be financed only by Governments. The Ordnance and Geological Surveys of our own and other countries are examples of Government departments carrying on this work. We need more of them. The presidents of the Botanical and Anthropological Sections are, I understand, directing the attention of the Association to the urgent necessity for complete Botanical and Anthropological Surveys of the kingdom. All geographers will warmly support their appeal, for the material which would be collected through such surveys is essential to our geographical investigations.

Another urgent need is a Hydrographical Department, which would cooperate with Dr. Mill's rainfall organization. It would be one of the tasks of this department to extend and coordinate the observations on river and lake discharge, which are so important from an economic or health point of view that various public bodies have had to make such investigations for the drainage areas which they control. Such research work as that done by Dr. Strahan for the Exe and Medway would be of the greatest value to such a department. We shall see how serious the absence of such a department is if we consider how our water supply is limited, and how much of it is not used to the best advantage. We must know its average quantity and the extreme variations of supply. We must also know what water is already assigned to the uses of persons and corporations, and what water is still available. We shall have to differentiate between water for the personal use of man and animals, and water for industrial purposes. The actualities and the potentialities can be ascertained, and should be recorded and mapped.

The Need for the Application of Geographical Methods to already Collected Data

In the second direction of research—that of treating from the geographical standpoint the data accumulated, whether by Government departments or by private initiative—work has as yet hardly been begun.

The topographical work of the Ordnance Survey is the basis of all geographical work in our country. The Survey has issued many excellent maps, none more so than the recently published half-inch contoured and hill-shaded maps with colors "in layers." Its maps are not all above criticism; for instance, few can be obtained for the whole kingdom having precisely the same symbols. It has not undertaken some of the work that should have been done by a national cartographic service—for instance, the lake survey. Nor has it yet done what the Geological Survey has done—published descriptive accounts of the facts represented on each sheet of the map. From every point of view these are great defects; but in making these criticisms we must not forget (1) that the Treasury is not always willing to find the necessary money, and (2) that the Ordnance Survey was primarily made for military purposes, and that the latest map it has issued has been prepared for military reasons. It has been carried out by men who were soldiers first and topographers after, and did not necessarily possess geographical interests.

The ideal geographical map, with its accompanying geographical memoir, can be produced only by those who have had a geographical training. Dr. Mill, in the monograph already referred to, has shown us how to prepare systematized descriptions of the one-inch map sheets issued by the Ordnance Survey.

The preparation of such monographs would seem to fall within the province of the Ordnance Survey. If this is impossible, the American plan might be adopted. There the Geological Survey, which is also a topographical one, is glad to obtain the services of professors and lecturers who are willing to undertake work in the field during vacations. It should not be difficult to arrange similar cooperation between the universities and the Ordnance Survey in this country. At present the Schools of Geography at Oxford and at the London School of Economics are the only university departments which have paid attention to the preparation of such monographs, but other universities will probably fall into line. Both the universities and the Ordnance Survey would gain by such coopera-

tion. The chief obstacle is the expense of publication. This might reasonably be made a charge on the Ordnance Survey, on condition that each monograph published were approved by a small committee on which both the universities and the Ordnance Survey were represented.

The Geological Survey has in recent years issued better and cheaper one-inch maps, and more attention has been given to morphological conditions in the accompanying monographs; but it is necessary to protest against the very high prices which are now being asked for the older hand-colored maps. The new quarter-inch map is a great improvement on the old one, but we want "drift" as well as "solid" editions of all the sheets. The geographer wants even more than these a map showing the quality of the solid rock, and not merely its age. He has long been asking for a map which would indicate the distribution of clay, limestone, sandstone, &c., and when it is prepared on the quarter-inch, or better on the half-inch, scale the study of geomorphology and of geography will receive a very great stimulus and assistance.

The information which many other Government departments are accumulating would also become much more valuable if it were discussed geographically. Much excellent geographical work is done by the Admiralty and the War Office. The Meteorological Office collects statistics of the weather conditions from a limited number of stations; but its work is supplemented by private societies which are not well enough off to discuss the observations they publish with the detail which these observations deserve. The Board of Agriculture and Fisheries has detailed statistical information as to crops and live stock for the geographer to work up. From the Board of Trade he would obtain industrial and commercial data and from the Local Government Board vital and other demographic statistics. At present most of the information of these departments is only published in statistical tables.

Statistics are all very well, but they are usually published in a tabular form, which is the least intelligible of all. Statistics should be mapped, and not merely be set out in columns of figures. Many dull Blue-books would be more interesting and more widely used if their facts were properly mapped. I say *properly* mapped, because most examples of so-called statistical maps are merely crude diagrams, and are often actually misleading. It requires a knowledge of geography in addition to an understanding of statistical methods to prepare intelligible statistical maps. If Mr. Bosse's maps of the population of England and Wales in Bartholomew's Survey Atlas

are compared with the ordinary ones, the difference between a geographical map and a cartographic diagram will be easily appreciated.

The coming census, and to a certain extent the census of production, and probably the new land valuation, will give more valuable raw material for geographical treatment. If these are published merely in tabular form they will not be studied by any but a few experts. Give a geographer with a proper staff the task of mapping them in a truly geographical way, and they will be eagerly examined even by the man in the street, who cannot fail to learn from them. The representation of the true state of the country in a clear, graphic, and intelligible form is a patriotic piece of work which the Government should undertake. It would add relatively little to the cost of the census, and it would infinitely increase its value.

The Need of Reorganizing the Geographical Factor in Imperial Problems

With such quantitative information geographically treated and with a fuller analysis of the major natural regions it ought to be possible to go a step further and to attempt to map the economic value of different regions at the present day. Such maps would necessarily be only approximations at first. Out of them might grow other maps prophetic of economic possibilities. Prophecy in the scientific sense is an important outcome of geographical as well as of other scientific research. The test of geographical laws, as of others, is the pragmatic one. Prophecy is commonly but unduly derided. Mendeléeff's periodic law involved prophecies which have been splendidly verified. We no longer sneer at the weather prophet. Efficient action is based on knowledge of cause and consequence, and proves that a true forecast of the various factors has been made. Is it too much to look forward to the time when the geographical prospector, the geographer who can estimate potential geographical values, will be as common as and more trustworthy than the mining prospector?

The day will undoubtedly come when every Government will have its Geographical-Statistical Department dealing with its own and other countries—an Information Bureau for the administration corresponding to the Department of Special Inquiries at the Board of Education. At present there is no geographical staff to deal geographically with economic matters or with administrative matters. Yet the recognition of and proper estimation of the geographical factor is going to be more and more important as the uttermost ends of the Earth are bound together by visible steel lines and steel

vessels or invisible impulses which require no artificial path or vessel as their vehicle.

The development of geographical research along these lines in our own country could give us an Intelligence Department of the kind, which is much needed. If this were also done by other States within the Empire, an Imperial Intelligence Department would gradually develop. Thinking in continents, to borrow an apt phrase of Mr. Mackinder's, might then become part of the necessary equipment of a statesman instead of merely an after-dinner aspiration. The country which first gives this training to its statesmen will have an immeasurable advantage in the struggle for existence.

The Need for the Adequate Endowment of Geography at the Universities

Our universities will naturally be the places where the men, fit to constitute such an Intelligence Department, will be trained. It is encouraging, therefore, to see that they are taking up a new attitude towards geography, and that the Civil Service Commissioners, by making it a subject for the highest Civil Service examinations, are doing much to strengthen the hands of the universities. When the British Association last met in Sheffield geography was the most despised of school subjects, and it was quite unknown in the universities. It owed its first recognition as a subject of university status to the stimulus and generous financial support of the Royal Geographical Society and the brilliant teaching of Mr. Mackinder at Oxford. Ten years ago Schools of Geography were struggling into existence at Oxford and Cambridge, under the auspices of the Royal Geographical Society. A single decade has seen the example of Oxford and Cambridge followed by nearly every university in Great Britain, the University of Sheffield among them. In Dr. Rudmose Brown it has secured a scientifically trained traveler and explorer of exceptionally wide experience, who will doubtless build up a Department of Geography worthy of this great industrial capital. The difficulty, however, in all universities is to find the funds necessary for the endowment, equipment, and working expenses of a Geographical Department of the first rank. Such a department requires expensive instruments and apparatus, and, since the geographer has to take the whole World as his subject, it must spend largely on collecting, storing, and utilizing raw material of the kind I have spoken of. Moreover, a professor of geography should have seen much of the World before he is appointed, and it ought to be an important part of his professional duties to travel frequently and

far. I have never been able to settle to my own satisfaction the maximum income which a department of geography might usefully spend, but I have had considerable experience of working a department the income of which was not very far above the minimum. Until now the Oxford School of Geography has been obliged to content itself with three rooms and to make these suffice, not merely for lecture-rooms and laboratories, but also for housing its large and valuable collection of maps and other materials. This collection is far beyond anything which any other university in this country possesses, but it shrinks into insignificance beside that of a rich and adequately supported Geographical Department like that of the University of Berlin. This fortunate department has an income of about 6,000*l.* a year, and an institute built specially for its requirements at a cost of more than 150,000*l.*, excluding the site. In Oxford we are most grateful to the generosity of Mr. Bailey, of Johannesburg, which will enable the School of Geography to add to its accommodation by renting for five years a private house, in which there will temporarily be room for our students and for our collections, especially those relating to the geography of the Empire. But even then we can never hope to do what we might if we had a building specially designed for geographical teaching and research. Again, Lord Brassey and Mr. Douglas Freshfield, a former President of this Section, have each generously offered 500*l.* towards the endowment of a professorship if other support is forthcoming. All this is matter for congratulation, but I need hardly point out that a professor with only a precarious working income for his department is a person in a far from enviable position. There is at present no permanent working income guaranteed to any Geographical Department in the country, and so long as this is the case the work of all these departments will be hampered and the training of a succession of competent men retarded. I do not think that I can conclude this brief address better than by appealing to those princes of industry who have made this great city of Sheffield what it is to provide for the Geographical Department of the University on a scale which shall make it at once a model and a stimulus to every other university in the country and to all benefactors of universities.

GEOGRAPHICAL RECORD

NORTH AMERICA

NEW YORK AND THE FOUR NEXT LARGEST AMERICAN CITIES IN 1910. According to the 1910 Census the growth of New York exceeds anticipation. The city at the Hudson mouth has now over 5,000,000 inhabitants in the four municipalities, New York, Jersey City, Hoboken and Newark. Furthermore it has gained over 1,500,000 since 1900. The city is still smaller than London, but its growth is over twice as rapid, and it will probably outgrow London in the next decade. A year ago it was pointed out (*Bulletin,* Sept., 1909) that there were in the real, closely settled, contiguous city in 1900, 3,636,000 people, after subtracting 330,000 inhabitants of thinly settled areas within the corporate limits that are not properly "city." The official figures of 1910 for the four political units are New York, 4,766,883; Jersey City, 267,779; Hoboken, 70,324; and Newark, 347,469, a total of 5,452,455. As some of the outer parts of the area have now the 10,000 to the square mile that has been used as the limiting value of "city" density, the sum to be subtracted now from the totals for included suburban dwellers is very likely less than in 1900. If we reduce the total above by that number, 330,000, we may confidently say that the real size of New York (anthropographic city) is over 5,120,000.

Chicago, which in 1900 had 1,500,000 people, with an allowance of 199,000 suburban dwellers, has now, making the same allowance, over 1,986,000 people, say 2,000,000.

Philadelphia with Camden, allowing 230,000 suburbanites then and now, had 1,142,000 in 1900 and now 1,413,000, a million and a half.

Boston and its contiguous neighbors, Cambridge, Somerville, Chelsea and Brookline, had 681,000 ten years ago and this year 826,000, after subtracting 87,000 for suburbs in both years.

St. Louis, which is, like Chicago, including everything citified in its neighborhood, had half a million in 1900 and now has 612,000†. 75,000 was subtracted for suburbs each time.

It was hoped by Director Durand of the Census to map the population densities in the larger cities in very small units, at times a city block. When these figures become available we shall have the best basis ever attained for the study of city population—density. For the present we may say that the five largest anthropographic or really urban cities in the United States in 1910 are:

New York*	5,120,000,	growth	148,000	a year.
Chicago	2,000,000	"	49,000	"
Philadelphia*	1,410,000	"	27,000	"
Boston*	830,000	"	15,000	"
St. Louis	610,000	"	11,000	"

The starred cities include contiguous cities. The rates of increase estimated last year for the same places were in round thousands per year 119, 52, 26, 15,

† A misprint at page 566 of the *Bulletin*, 1909, made the anthropographic population of St. Louis in 1900, 575,000. Another, at page 540, gave Philadelphia officially 1,648,000, which should have been 1,293,697.

10. The last four are pretty much as estimated but New York's increase is twenty-four per cent. greater than was then anticipated. M. J.

FUTURE WHEAT SUPPLY. In a paper on "The Future Wheat Supply of the United States," by M. A. Carleton of the U. S. Dep't. of Agriculture (*Science,* Aug. 5, 1910, pp. 161-171), the author gives data which seen to point to the conclusion that from 75,000,000 to 100,000,000 acres will be added to the farm area of the United States, exclusive of Alaska, from the 386,873,787 acres of government lands "unappropriated and unreserved" in 1908 and by additions from present Indian reservations, "unallotted and unreserved," at the close of the fiscal year, 1908. With the natural expansion of farm area in the older states, which will be greater hereafter than heretofore, it seems reasonable to expect 250,000,000 to 300,000,000 acres of additional farm area within the next thirty years. By 1950, therefore, a conservative estimate would make the total farm area of the country more than 1,300,000,000 acres. The average proportion of farm area used for wheat since 1870 has been 5.2 per cent., and this percentage of the future possible farm area would be over 69,000,000 acres, or 22,000,000 acres more than the acreage of 1909.

But the tendency of the wheat acreage is now to increase in the same farm area and, long before 1950, it should again reach 6 per cent. as it did before the wheat depression in the nineties, both because of wheat growing expansion due to increase in prices and because the farm area will hereafter increase less rapidly. In 1910 the wheat acreage is 50,500,000 acres. In 1950, at the rate of 6 per cent. increase, the wheat acreage should be about 80,000,000 acres. The yield of wheat, per acre, is increasing and within the past 30 years the increase has been fully two bushels per acre. Other considerations are also adduced to show that improvements in varieties of wheat, in methods of farming, etc., may raise the yield by 1950, to twenty bushels to the acre, 80,000,000 acres of wheat thus producing 1,600,000,000 bushels.

Basing his estimate of increase of population upon the ratio of increase since 1880, Mr. Carleton assumes that the census will show 160,000,000 inhabitants in 1950, requiring, at the rate of seven bushels of wheat per capita, 1,120,000,000 bushels, leaving a surplus of 480,000,000 bushels. By a similar line of reasoning, he figures that the world will require by 1950, about 5,500,000,000 bushels of wheat, an increase of 2,000,000,000 bushels over present production. The estimated total increase of production will more than fill this requirement. All of Mr. Carleton's estimates and assumptions are well fortified by data relating to increase of population and increase of wheat production and consumption and his paper is a valuable and suggestive contribution to this vital topic.

MACKENZIE MOUNTAINS. In a recent publication of the Geological Survey of Canada* J. Keele introduces a new name in the nomenclature of the Rocky Mountain System. He wishes to designate by "Mackenzie Mountains" the entire mountainous region forming the water-parting between the upper Yukon and the upper Liard, on one side, and the Mackenzie, on the other, and extending in an arc convex to the northeast from the sources of the Porcupine River in 65½° N. to the bend of the Liard River in 59½° N. The Mackenzie Mountains would, therefore, be coincident with the Ogilvie and Selwyn Ranges as defined by the undersigned in a recent paper.† Keele wishes the comprehensive

* A Reconnaissance across the Mackenzie Mountains on the Pelly, Ross and Gravel Rivers, by J. Keele, 1910. [No. 1097]. p. 13.

† *Bull.* Amer. Geog. Soc., Vol. XLII (1910), pp. 176-177.

term to supersede the two distinct names (which he as well as other members of the Survey staff have used in previous reports) because "it has been found impossible to define the limits of these subdivisions, on topographic grounds." He, however, retains the name Selwyn Mountains (in this form) for that part of the Mackenzie Mountains in which the upper branches of the Macmillan and Ross Rivers head. (*cf.* the map accompanying the report.) To the Ogilvie Range he does not wish to assign definite limits; the name, however, appears on the map accompanying the report near the Arctic-Pacific watershed at the head of the Stewart River.

Although these names can only be considered tentative, and no nomenclature laying any claim to finality is possible before we possess a far more thorough knowledge of the region, all such efforts to define geographic units are to be welcomed because of the clearer conception they lead to of the relations of the parts to the whole. Thus, whatever their name, Keele recognizes the Mackenzie Mountains as a northern member of the Rocky Mountain System. Whether the term should be made to include the whole width of this portion of the Rocky Mountain System between the Central Plateau Region and the basin of the Mackenzie River, or whether it should merely be applied to the outer, or eastern, belt of the System, as the region of low relief lying northeast of the course of the Pelly River and separated from the main body of the Central Plateau Region by the Glenlyon and Pelly Mountains would seem to indicate, cannot at present be decided. W. JOERG.

DENUDATION IN THE UNITED STATES. Messrs. R. B. Dole and H. Stabler have a paper in Water Supply Paper 234 entitled "Denudation" in which they present estimates of the rate of denudation in the United States. The computation of denudation factors are based on figures representing the amount of mineral matter carried by streams, the size of the areas tributary to the streams, and the quantity of stream water discharged. The sources of data are discussed and the summary presents in tabular form denudation estimates for the primary drainage basins and for the whole country.

"The tons per square mile per year removed from different basins present interesting comparisons. In respect to dissolved matter, the southern Pacific basin heads the list with 177 tons, the northern Atlantic basin being next with 130 tons. The rate for Hudson Bay basin, 28 tons, is lowest; that for the Colorado and western Gulf of Mexico, basins, is somewhat higher. The amounts are generally lowest for streams in the arid and semi-arid regions, because large areas there contribute little or nothing to the run-off. The southern Pacific basin is an important exception to this general rule, presumably because of the extensive practice of irrigation in that region. The amounts are highest in regions of high rainfall, though usually the waters in those sections are not so highly mineralized as the waters of streams in arid regions.

"Colorado river brings down the most suspended matter, 387 tons per year for each square mile of its drainage basin. Practically no suspended matter is transported by St. Lawrence river. The Mississippi apparently discharges more material than is brought in by its tributaries, thus indicating that its lower valley is still being eroded.

"The estimates reveal that the surface of the United States is being removed at the rate of thirteen ten-thousandths of an inch per year, or one inch in 760 years. Though this amount seems trivial when spread over the surface of the country, it becomes stupendous when considered as a total, for over 270,000,000

tons of dissolved matter and 513,000,000 tons of suspended matter are transported to tide water every year by the streams of the United States. This total of 783,000,000 tons represents more than 350,000,000 cubic yards of rock substance, or 610,000,000 cubic yards of surface soil. If this erosive action had been concentrated upon the Isthmus of Panama at the time of American occupation, it would have excavated the prism for an 85 foot level canal in about seventy-three days."

THE PAN AMERICAN UNION. The name of The International Bureau of the American Republics has been changed to "The Pan American Union." Its monthly publication has the name "*Bulletin* of the Pan American Union," from the October number.

STATE GEOLOGICAL SURVEY OF TENNESSEE. The legislature of Tennessee provided for the organization of this survey at its last session. Under the law, a State Geological Commission was appointed consisting of the Governor, the Commissioner of Agriculture, the Chief Mine Inspector, the President of the University of Tennessee, the Chancellor of Vanderbilt University and the Vice Chancellor of the University of the South. The Commission has elected Mr. George H. Ashley as State Geologist. He was formerly connected with the U. S. Geological Survey. Mr. L. C. Glenn and Mr. C. H. Gordon have been chosen as associate geologists. By working, like several of the other state surveys, in cooperation with several of the national bureaus, the total product of the field studies will be greatly enlarged. Besides the accumulation of geological data the survey will give special attention to the study of the natural resources of the state. It is expected to issue Bulletins as fast as work is completed.

TWENTY-FIVE YEARS OF THE BLUE HILL METEOROLOGICAL OBSERVATORY. This private, scientific establishment, founded and supported by A. Lawrence Rotch, has now been in existence a quarter of a century. The occasion is improved by the *Technology Review* to print a short paper on the Observatory and its work (Vol. xii, No. 2). It has made a continuous record of the meteorological phenomena, at its elevation of 635 feet, and has long been engaged in the study of the upper air by means of kites. It was one of the first of our stations to be equipped with self-recording instruments, is one of the few in the world where nearly every element is continuously recorded, no other station has studied the upper and lower air so long, many new types of instruments have been made and the long labors and results of Mr. Rotch and his able staff have everywhere commanded attention. While the observatory is still independent of outside control, it is attached to Harvard University and publication is made in the *Annals* of the Astronomical Observatory.

PROMOTIONS. J. Paul Goode and H. H. Barrows, geographers of the University of Chicago, have been promoted from the position of Assistant Professors to be Associate Professors.

AFRICA

THE FRENCH GUINEA RAILROAD COMPLETED TO THE UPPER NIGER. The railroad which, for some years, has been building across the French Guinea Colony was completed, on Sept. 15, to Kouroussa on the upper Niger. It will now be extended about 100 miles further southeast to Kankan. The route extends inland from Konakry, the chief port and capital of the colony. This enterprise will be of great importance in the development of the large resources of French Guinea.

ASIA

FAILURE OF THE CHINESE CENSUS. According to the "Ostasiatische Lloyd," as reported in *Globus* (vol. xcviii, No. 4), the attempt of the Peking government to enumerate the population in the first year of the new Emperor, is practically a failure. The populace feared that the census was to form the basis for the imposition of new taxation and refusal to give information was general. The enumeration was fairly successful only in the treaty ports and the chief cities and no returns of any sort were received from four of the provinces. Furthermore, no one without a fixed abiding place was counted and so the vast number of boatmen, coolies, wheelbarrow men, beggars, etc., were not enumerated. Under the circumstances, the figures published by the government have very little value.

DR. SVEN HEDIN'S SCIENTIFIC RESULTS. The scientific results of Dr. Hedin's journey in Tibet (1906-08) will consist of three volumes of memoirs and an atlas in two volumes. The text will embrace about 1,500 pages and will comprise reports on geographical discoveries and observations, memoirs on the physical geography of Tibet and papers by Dr. Hennig on geology, Prof. Lagerheim, Dr. Ostenfeld and others on botany, Dr. Olsson on astronomical observations and Dr. Ekholm on meteorology and hypsometry. It is expected that the memoirs will appear in 1911, 1912 and 1913 and the Swedish government has voted 75,000 kroner towards the cost of publication. Dr. Hedin's detailed map of Tibet on a scale of 1:1,000,000, will appear in 1912.

JAPANESE WHALERIES. Since the Russo-Japanese war, the whaling industry, formerly flourishing in Japan and Corea, has had a great revival in both countries. Japanese whaling vessels, in the year ending September, 1908, captured 1,784 whales of a value of $1,200,000. The most southern of the whaling ports is Hososhima, in the province of Hyuga and the most northern is the island of Kinkasan, to the northeast of Sendaï, on the east coast of Nippon. The whaling stations of Corea are at Oul-san on the southeast coast and near Wön-san on the east coast. Seven companies are engaged in the business, the largest of which hunts the whale in the Pacific and on the east coast of Corea. The government now authorizes whaling as far as the south end of Formosa where these animals are said to be abundant. Japan proposes to adopt strict rules to prevent the extermination of the whales.

OBITUARY

PROFESSOR WILLIAM H. NILES. Prof. Niles died on Sept. 13 at the age of 72 years and 3 months. He was professor of geology and geography in the Institute of Technology, Boston, from 1871 to 1902 and had been the head of the department of geology at Wellesley College since 1888. Well known as a teacher and lecturer, he was also conspicuous as the author of papers on glacial phenomena and on the geology and physical geography of Massachusetts. He was president of the Boston Natural History Society from 1892 to 1897.

PROFESSOR Z. CONSIGLIERI PEDROSO. The Society regrets to announce the death of Professor Pedroso, President of the Geographical Society of Lisbon, of which event it is informed by a communication from that Society under date of Sept. 3d, ult.

PROF. DR. THEOBALD FISCHER. Prof. Dr. Theobald Fischer, professor of geography at the University of Marburg, Prussia, is dead at the age of 64. He was a geographer and teacher of wide reputation.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

AMERICA

The Grand Canyon of Arizona. How to See It. By George Wharton James. With numerous illustrations of points of interest and maps. 8vo, pp. xii and 265. Little, Brown & Co., Boston, 1910. $1.50.

The great division of the long line of chasms of the Colorado River of the West, named in 1869 by Major Powell "The Grand Canyon," has become famous and each year is visited, on the south side of the eastern portion, by thousands of tourists. No adequate guide book existed till Mr. James brought out this one to supply the deficiency. It is elaborately and carefully prepared and there seems to be no point of interest which has been overlooked. The book will be truly invaluable to every visitor in answering the many questions that are certain to arise. There are numerous good photographs in half-tone and a "Detail Map of Granite Gorge Section" which is the part immediately under the terminal of the railway, and east and west from it, for a total of about 35 miles in an air line. The detail is mainly in the place-names, not in the topography, and one is reminded again by these names of the mistaken ideas we seem to have in this country as to proper geographic nomenclature. Our Troy, Rome, Carthage, Athens, Corfu, Cairo, etc., it would appear, should have taught us better, but here in the majestic Grand Canyon region, where simplicity ought to prevail, the grandiose effort is repeated, and we have, alas! Walhalla, Ottoman, Krishna, Shiva, Buddha, Sagittarius, Zoroaster, and an interminable list of like monstrosities applied to buttes and promontories, due to a schoolboy-phase of culture. Anthon's Classical Dictionary is not the proper source for United States place-names.

The first white men to see the great gorge are believed to have been Captain Cardenas and his party of Coronado's expedition in 1540; at any rate, they hold the record. Cardenas has been credited with the statement that the chasm was three or four leagues deep, notwithstanding the absurdity of such a description coming from an educated gentleman belonging to the Spanish nobility. Mr. James quotes this statement on p. 196, from some un-named translator: "they came to the banks of the river which seemed to be more than three or four leagues above the stream which flowed between them." Think of an explorer who could talk of a canyon from nine to twelve miles deep.

The original statement as it occurs in the Castañeda manuscript in the Lenox Library (the source of almost all the information about Coronado and his men) is this: *"a las barrancas del rio que puestos a el lado* (or *bado,* the word is indistinct) *de ellas parecia al otro bordo que auia mas de tres o quatro leguas por el ayre."* The reviewer has compared this transcript with

the manuscript, and with the exception noted as to b or l in *lado,* it is correct. The statement is readily seen to refer to the distance from one side of the canyon's brink to the other in an air line and it has no reference to depth. The distance is actually from 9 to 12 miles. This distortion has been due to careless reading. In Winship's Monograph (14th Ann. Rept. Bur. Am. Eth., Part II, p. 429) the Spanish of this passage is accurately given, with the exception of the b or l as noted above (he gives bado), but when he comes to translate he follows the time-honored mistake, giving the phrase as Mr. James quotes it, and referring in a foot-note to the French translation of Ternaux-Compans, as if that writer's error made the case any better. This reads: "Les bords sont tellement élevés qu'ils croyaient être à trois ou quatre lieues en l'air" (the banks were so high they seemed to be three or four leagues in the air). [Voyage de Cibola, p. 62, Vol. IX, T-C, Voy. & Rel., Bertrand, 1838 ed.] There is no reason to suppose that this author had any other source than that now in the Lenox, a MS. copy, 1596, of Castañeda's original, which has never been reported. This error, perhaps, is of small consequence, but we have gone into the subject here in order to stop its career, in the belief that every error is pernicious. Mr. James, of course, is in no way to blame, as he quoted what he believed to be authority.

As to the canyon itself, Mr. James speaks largely from actual experience, having "knocked about" the region a great deal. He was one of the first to give any extended description of the Havasupais who live in the depths of the Havasu tributary canyon, of which he gives an account in this volume.

The New North. Being some Account of a Woman's Journey through Canada to the Arctic. By Agnes Deans Cameron. xix and 398 pp., many photo-engravings and route map. D. Appleton & Company, New York, 1910.

Miss Cameron travelled through Canada, some thousands of miles, from Manitoba to the Arctic Ocean at the Mackenzie Delta. She has written a delightful travel book whose special value lies in its descriptions of development work north of Edmonton. Her photographs of this northern region are among the finest yet assembled and, with her graphic letterpress, they give a clear idea of the routes, settlements, white residents, Indians, Eskimos, trading posts and the bit of farming that has found lodgment in the Peace Valley, 400 miles north of Edmonton, where wheat, oats, barley and vegetables are reliable crops. Among many novelties, she shows the salt beds of Athabasca and the efforts to open the petroleum field in the same region. The book is well worth reading.

Our Search for a Wilderness. An Account of Two Ornithological Expeditions to Venezuela and to British Guiana. By Mary Blair Beebe and C. William Beebe, Curator of Ornithology in the New York Zoölogical Park, etc. Illustrated with Photographs from Life, taken by the Authors. xix and 408 pp., maps showing routes, and index. Henry Holt and Company, New York, 1910. $2.75.

It is a satisfaction to know that the authors of this volume have received pleasure, as well as conferred it, by their studies of the fauna of a portion of South America which is somewhat remote from all frequented routes of travel though it lies rather near to the southern boundaries of our country; that they were powerfully attracted by "the thought of that vast continent [South

America], as yet almost untouched by real scientific research," and have tasted "the supreme joy of learning, or discovering." In explanation of the not wholly obvious meaning of the title, it may be said that the wilderness sought by these authors was one which could be truthfully called an untrodden region—jungles untouched by ax or fire (as they express it), where guns have not replaced bows and arrows; where the creatures of the wilderness are tame through unfamiliarity with human beings.

Their first expedition, in 1908, developed in quite novel fashion the latent interest of mangrove forests in the northern part of the Orinoco delta. Leaving Port of Spain, Trinidad, in a Venezuelan sloop, they cruised among the streams north of that great delta and explored the country around La Brea, the Venezuelan Pitch Lake. Their second "search" was conducted under decidedly favorable conditions, in the forest, river, and savanna regions of British Guiana. Both trips, they assure us, were successful; for the regions they explored were wilderness wonderlands,—"full of beauty, abounding in the romance which ever enhances wild creatures and wild men, and they were part of the great zoölogical 'dark continent' which we hope to devote our lives to studying." Especially interesting descriptive passages are those which relate to protective coloration (pages 17, 18, 341, etc.), the dancing crabs (page 16), and the hunting-ants. Here is a paragraph taken from the account of the last-mentioned marauding army:

"We dropped five big black ants into the midst of the marauders, and witnessed a combat as thrilling as the contest between the Greeks and Persians. Four of the insects alighted on a small rounded stone over which three hunting-ants were scurrying. Without hesitation the black giants fell upon the brown warriors and tore them limb from limb, with the loss of only half a leg. This is not a very serious handicap when one has five and a half robust limbs left! The fifth big fellow dropped upon a mass of ants piled like football-players upon a struggling scorpion, whose sting was lashing the air in vain. The big ant started another ripple upon this pool of death, which soon smoothed away, leaving no recognizable trace of him. But the quartet of big-jawed fellows on their rock citadel fought successfully and well. No ant which crept to the top ever lived to return for help. The four flew at him like wolves and bit him to death. Soon a ring of hunting-ants formed around the stone, all motionless except for a frantic twiddling of antennæ. They were apparently excited by the smell of the blood of their dead fellows, and only rarely did one venture now and then to scale the summit. When we left, two hours afterward, the army had passed, and left the stone and its four doughty defenders, who showed no immediate intention of leaving their fortress." MARRION WILCOX.

AFRICA

Geological and Archæological Notes on Orangia. By J. P. Johnson. iii and 102 pp., 40 illustrations, bibliography and index. Small 4to. Longmans, Green & Co., New York and London, 1910.

A condensed survey of the geology and archæology of the Orange River Colony, South Africa. Mr. Johnson's work both as a geologist and an archæologist in this part of Africa is well known. In this volume he gives a geographical description of the colony, four chapters on the geology, diamond mines and physiography, three on archæology, with drawings of petroglyphs and rock

paintings, one on farming prospects and a bibliography with sixty-five titles. He says that the conservation of moisture in the soil by means of deep plowing is proving successful in the cultivation of the dry lands.

The Handbook of Nyasaland. Comprising Historical, Statistical and General Information concerning the Nyasaland Protectorate. First year of publication. Compiled from official and other reliable sources. 292 pp. and illustrations. The Government Printer, Zomba, Nyasaland Protectorate, 1909. 3s. 6d.

A useful compilation including all phases of the development work in the Protectorate.

ASIA

L'Empire japonais et sa Vie économique. Par Joseph Dautremer, Consul de France. 308 pp., map and illustrations. Librairie Orientale et Américaine. E. Guilmoto, Editeur. Paris, 1910. F. 6.

The two parts of the title correspond to the two principal divisions of the book. It contains, first, a brief outline of the geography of Japan, and, secondly, a survey of its economic resources and activities. Compiled from various official and unofficial sources by the hand of one who knows the country through personal acquaintance, it is a handy guide to the land of the rising sun for the student as well as the prospective trader. One must beware, however, of too readily adopting the author's patronizing attitude towards modern progress in Japan, which betrays the tourist's way of looking at things rather than that of the scholar, the traveler, the philosopher, who tries to understand, and account for, what seems foreign to him. Nations ought to be judged by their aims and ideals, as embodied in their best men, quite as much as by the discrepancy, often ridiculous, between them and the crowd behind the leaders. A Japanese traveling in France, or in any other of the western countries, might make there, eventually, some observations quite as startling as the author records of Japan.

M. K. G.

NEAR EAST

Kairo—Bagdad—Konstantinopel. Wanderungen und Stimmungen von E. v. Hoffmeister, General-leutnant z. D. x and 262 pp., illustrations and map. B. G. Teubner, Leipzig, 1910. M. 8.

The author, a retired German army-officer, has traveled extensively in many parts of the nearer East, some of which are rarely visited by travelers; and he has also supplemented his travels by collateral studies. With his heart full of his favorite subject we can understand that he could not help speaking about it in public, and many a reader of the magazine in which he published his earlier articles certainly has thanked him for a pleasant hour of reading. But it is a pity that successes of this kind too often lead a writer to overestimate his literary and scientific abilities. To write up "the Past and Present of the nature and the people of the Orient," as the author attempts in this book, and to "develop his report into a philosophy of travel," by interweaving it with his personal impressions and reflections, is more than the amateur can ever hope to accomplish. Hence, measured by the ambition of the author, the book is a perfect failure; for the first part of his book he lacks the qualities of the geographer and the historian, and for the latter those of the philosopher.. He is a pleasant

elderly gentleman to whose interesting talks we like to listen, but to whom scientific standards and points of view are entirely foreign. Nothing can, perhaps, illustrate this better than the fact that of the 157 pictures, many of them very good, more than two-thirds are inserted without any indication of what they represent, so that one must look up the index to inform himself about their subjects. The fundamental difference between scientific and amateur work shows nowhere better than in the chapter on the Bagdad Railroad, on which, as a former member of the German army, the author can speak as an expert. That part of his book is really valuable; but the rest is simply a series of pictures and adventures which succeed each other like so many pearls on a string, and of would-be aphorisms which hardly ever rise above the level of commonplace. M. K. G.

AUSTRALASIA AND POLYNESIA

The Year-Book of Australia, 1910. lvi and 781 pp., 5 maps and index. 8vo. Gordon & Gotch, London, 1910. 10s. 6d.

Published under the auspices of the governments of the Commonwealth and States. It is the official record of the statistics, governmental departments, institutions, conditions and progress of Australia.

Wanderings Among South Sea Savages. By H. Wilfred Walker. xvi and 254 pp. 48 plates from photographs and index. Witherby & Co., London, 1910. 7s. 6d.

These are interesting chapters of experiences in Fiji, British New Guinea, Luzon and Borneo; and they are all the more interesting because they are a by-product of the author's serious pursuits as an ornithologist. It will, therefore, be understood that he does not pretend to be a geographer or an ethnologist. He writes of the things that interested him with a confidence that they will interest the readers who feel an attraction to his volume. Thus it comes to pass that he has given a valuable account of his experiences with the Negritos of Luzon and that he has given the best description anywhere in print of the Borneo caves where the birds build their nests for a Chinese soup.

In New Guinea he was particularly fortunate in being able to join a punitive expedition directed against the Dobudura in the interior of the north coast of the possession, a tribe never before visited by white men. There was some hard fighting and the constant excitement of a jungle scouting expedition for wild cannibals. The author enjoyed it all and has given us a narrative which must stand as the beginning of geographical acquaintance with that part of New Guinea. He broke new ground in another direction in the same region; he penetrated inland from Cape Nelson to the swamp-bordered lake in which the Agai Ambu (Seligmann names them Agaiambo) live in houses set on piles and lead a life so aquatic that it was long believed that they were web-footed. Mr. Walker somewhat regretfully disposes of this myth, for he says that they are not web-footed, although he observes "between the toes an epidermal growth more distinct than in the case of other peoples."

The governor of the possession, Sir Francis Winter, who followed Mr. Walker on a visit to the lake people, says nothing about the web or the epidermal growth. Both authorities agree on the statement that the Agaiambo walk so rarely on the ground that they cannot do it properly and their feet bleed when they attempt it.

Such unpretentious records must have a great value in clearing the way for the better knowledge of such unfamiliar lands as those which the author has penetrated. This value is by no means temporary, a record of the things which have interested a traveler may contain matter of much permanent importance. This is strikingly illustrated in this work. In a kampong of Dyak headhunters in Borneo Mr. Walker amused a group of young and old by showing them pictures in an illustrated paper. The manner in which they looked at the pictures, upside down, attracted his attention enough for a brief note.

It happens that this involves a matter concerning which the works on psychology and optics are wholly silent. So far as diligent search warrants the statement, there are but four other references to this obscure but interesting phenomenon. W. C.

EUROPE

Geologischer Führer durch Dalmatien. Von Dr. Richard Schubert. xxiii and 176 pp., 18 text illustrations and a geological sketch map. Gebrüder Borntraeger, Berlin, 1909. M. 5.60.

This little book is No. 14 in the series of geological guides which the Borntraeger Brothers are publishing for the benefit of the traveling public. Anyone who realizes the influence of geology upon the shaping not only of land forms but also of human activities can see what new sources of interest such a guide as this may open to him. The book shows what may be observed, geologically, on excursions from various starting points in Dalmatia; and its helpfulness should be a source of pleasure even to the layman.

Central Italy and Rome. Handbook for Travellers. By Karl Baedeker. Fifteenth revised edition. lxxxii and 525 pp., 19 maps, 55 plans and views and the Arms of the Popes since 1417. Karl Baedeker, Leipzig, 1909. M. 7.50.

This standard guide book, thoroughly brought up to date, is likely to be useful to an unusually large number of tourists during the coming fifteen months. In October, 1911, a week will be given in Rome to the commemoration of the proclamation of the Kingdom of Italy. Fall and winter travel in Italy is increasing every year and is expected to be unusually large next year. In this edition of the Handbook, 364 pp. are given to Rome; and among the many maps, those of Elba, and the environs and plans of Elba, Siena, Montepulciano, San Gimignano and Urbino appear for the first time.

Life in the Orient. By K. H. Basmajian. Third, revised edition. 277 pp., and many illustrations. American Tract Society, New York, 1910. $1 net.

In this edition, new chapters show the present conditions in Turkey, and the pictures, also, are new. This is an authoritative work by a native Turk, who was converted to Christianity in his boyhood, has been many years in the missionary service and writes of Oriental matters as none but a native can do. The book is replete with information on all phases of Turkish life.

GENERAL

Military Map Reading. By Captain C. O. Sherrill, Corps of Engineers, U. S. A. 46 pp., 22 figures and map of Fort Leavenworth, Kan. Fort Leavenworth, 1909. 50c.

This manual is used in the U. S. A. Service Schools at Fort Leavenworth

and has been distributed by the War Department to the officers of the organized militia, 9,000 copies being printed in the first edition. It is an elementary work on the reading and construction of maps, and is fully adequate for the purposes designed. It explains and illustrates scales, contours, hachures, and other elements of map-making, gives map problems, and treats of the determination of directions, orientation of maps, determination of the true meridian, etc. While the book is designed for military classes, most of it will be very helpful to all who may desire to cultivate the reading and understanding of maps.

The Story of the American Merchant Marine. By John R. Spears. 340 pp. and 15 illustrations. The Macmillan Company, New York, 1910. $1.50.

For over twenty years, Mr. Spears has been regarded as an authority on American sea enterprises. The books from his pen are based upon long study of the topics he treats. His facts are always clearly presented, his narrative is interesting and he spares no pains to attain accuracy. In the present volume, he tells the story of our merchant marine from its beginnings, through all the phases of its history and of the depression that has marked this feature of our activities since the civil war.

Physical History of the Earth in Outline. By James B. Babbitt. vi and 229 pp., and Appendix. Sherman, French & Company, Boston, 1909. $1.40.

The title of the book is somewhat misleading. What the author wants to demonstrate is not so much the history of the earth in general as his particular theories on the causes and extent of the glacial period, to which the rest forms merely an introduction. His argumentation culminates in a refutation of the hypotheses of a "geologic" or "cosmic" winter and the existence of a polar ice cap as causes of the glacial period, and he substitutes for them a transverse rotation of the earth which would effectuate changes in the obliquity of the earth's axis and, hence, changes in the location of the Arctic zone and climate. As it appears, from ancient as well as most accurate modern observations, that within the last thirty centuries the poles have turned or moved in a direction at right angles to the axis of the diurnal rotation, this movement may be supposed to be continuous and, if so, cycles of such a rotation would correspond to climatic cycles during which ice ages would alternate at the poles and the equator and migrate, as it were, all around the earth between these two.

In a book like this, however, which is supposed by its author to be ranked as a scientific publication, that author should not play hide-and-seek with his readers as he does here. Not only does the title-page observe the strictest discretion as to the profession, position, or general scientific qualifications of the author, but there is not even a preface to introduce him and his work to us, nor a bibliography by means of which we might assign him his place in the long line of workers on these problems, nor a subject index that might enable us to cross-examine his theories. These omissions are especially regrettable, not only because they will shake the faith of many a reader in the scientific earnestness of the author, but even more because his transverse rotation is a very near relative of another hypothesis long established by Professor Simroth of Leipzig, namely, the "Pendulation Theory," and the principal interest and merit of the book lies in the points of resemblance and divergence that it con-

tains in comparison with that older theory. What Mr. Babbitt wants to prove on geological and astronomical evidence has long been anticipated, for biological reasons, by the Leipzig scholar. The latter does not, however, suppose the transverse motion to be a complete rotation but a pendulation along a swinging plane of which he has even determined the poles: an East pole on Sumatra and a West pole in Ecuador. Between the two, the swinging plane would pass through Bering Straits on the western and through Kamerun on the eastern hemisphere. Yet Professor Simroth's name is not even mentioned in Mr. Babbitt's book, nor is that of Dr. Arldt of Radeberg (Saxony), the noted specialist on the Permian glacial period, a period which, by the way, is entirely excluded from Mr. Babbitt's synopsis of glaciation on the Southern hemisphere. (See review of Dr. Arldt's book, *Bull.*, Vol. 42, 1910, pp. 295-96.) A revised and enlarged edition of Mr. Babbitt's book, which would consider the opinions of living scholars as well as of those of the past, and which would show more definitely the author's position among his fellow scientists in this field, might become a real contribution toward a solution of these much discussed problems.

M. K. G.

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NEW MAPS

NORTH AMERICA

U. S. GEOLOGICAL SURVEY MAPS

COLORADO AND NEW MEXICO. (a) Map of South Park Coal Field, Col. 1:125,000=1.9 mile to an inch. Black. By C. W. Washburne. [Shows formations, coal mines and prospects]; (b) Map of Colorado Springs Coal Field, El Paso Co., Col. 1:125,000. Black. By Marcus I. Goldman. [Shows geological formations and sections of coal beds on vertical scale of 5 feet to an inch]; (c) Map of Canon City Coal Field, Col. 1 mile=.75 inch. Black. By C. W. Washburne. [Shows formations and coal horizons]; (d) Map of Trinidad Coal Field, Col. 1:187,500=3 miles to an inch. Black. By G. B. Richardson, D. E. Winchester and J. H. Gardner. [Shows formations, distribution and names of mines and structure sections]; (e) Map of Carthage Coal Field, N. M. 1 inch=1.25 mile. Black. By J. H. Gardner. [Shows formations, coal-bearing rocks, coal mines and outcrops]; (f) Map of Coal Field between San Mateo and Cuba, N. M. 1:500,000=7.89 miles to an inch. Black. Bv J. H. Gardner and A. L. Beekly. [Shows formations, coal-bearing rocks, coal mines and exposures and location of fossils. These maps illustrate *Bull.* 381-C: "Investigations of Coal Fields in Colorado and New Mexico by the U. S. Geol. Surv. in 1908," by G. C. Martin, C. W. Washburne, M. I. Goldman, G. B. Richardson and J. H. Gardner. Washington, 1910.]

MAINE. Geologic map of the mineralized area of Bluehill, Brooksville, Deer Isle and Castine, Me. 1:125,000. In colors. Contour interval, 20 feet. 1909. [Illustrates *Bull.* 432: "Some Ore Deposits in Maine and the Milan mine in N. H." By W. H. Emmons. Washington, 1910.]

UNITED STATES. (a) Map showing the principal Manganese Mines and the probable extent of the Ore-bearing Areas in Va. 1 inch=17 miles. Black. (b) Map showing the distribution of Manganese and Manganiferous ore deposits in the U. S. 1:11,875,000=187.42 miles to an inch. Colors. In Pocket. [Illustrate *Bull.* 427: (Manganese Deposits of the U. S., with sections on Foreign Deposits, Chemistry and Uses," by Edmund C. Harder. Washington, 1910.]

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Charts of the North Pacific Ocean, Nov. and Dec., 1910.

Pilot Chart of the South Pacific Ocean, Dec., 1910, Jan. and Feb., 1911.

U. S. WEATHER BUREAU CHARTS

Meteorological Chart of the North Atlantic Ocean, Nov., 1910.

Meteorological Chart of the North Pacific Ocean, Nov., 1910.

U. S. DEPARTMENT OF AGRICULTURE MAPS

UNITED STATES. Soil Survey Maps of Tift Co., Ga.; Lincoln Parish, La.; Orono Area, Me.; Auglaize Co., Ohio; Saluda Co., S. C. 1:62,500 and 1:63,360. [In colors, with contours of elevation and descriptive text.]

UNITED STATES. New York City. Routes of the Interborough Rapid Transit Company. 5½ inches=one mile. [Includes the Borough of Manhattan and the parts of Brooklyn and the Bronx served by the subway (red) and elevated (blue) lines. Dockage facilities along the Manhattan and a large part of the Brooklyn, Bronx and New Jersey water fronts are clearly shown and lettered.]

CANADA. Rocky Mountains between Lat. 51° and 53° 10′. 1:253,440=four miles to an inch. 2 Sheets. Dept. of the Interior, R. E. Young, Chief Geographer, Ottawa, 1910.

SOUTH AMERICA

BRAZIL. São Paulo. Carta Geral do Estado de São Paulo. Com indicaçoes sobre a agricultura, commercio, instrucção publica, industria e colonisação. 1:2,000,000=31.56 miles to an inch. In colors. (Preliminary Edition.) Commissão Geographica e Geologica, João P. Cardoso, Chefe. São Paulo, 1910. [Shows communications, telegraphs, industrial centers, distribution of forests and plains, and of coffee, cane, rice, cotton and other plantation crops.]

AFRICA

ALGERIA. Algérie Nord. 1:1,600,000=25.2 miles to an inch. In colors. Dressée par le Gouvernement Général de l'Algérie, Direction de l'Agriculture, du Commerce et de la Colonisation, 1905. [Shows the areas set apart for colonization from 1830 to 1905, concessions of land and forests, centers of native population, military stations, rail and wagon routes, etc.]

ALGERIA. Carte des Divisions administratives de l'Algérie. 1:3,200,000=50 miles to an inch. In colors. Gouvernement Général de l'Algérie, Direction de l'Agriculture, du Commerce et de la Colonisation, Service cartographique, 1910. [Shows areas of territories occupied by communes exercising full or partial political powers, the areas under military control and the Territories of the South.]

ALGERIA. Algérie Nord. Forêts domaniales, communales et particulières. 1:1,600,000=25.2 statute miles to an inch. In colors. Dressée par le Gouverne-

ment de l'Algérie, Direction de l'Agriculture, du Commerce et de la Colonisation. 1905. [Four tints for forest areas.]

ALGERIA. Cartes des Voies de Communication. 3 Sheets: (a) Département d'Alger; (b) Département de Constantine; (c) Département d'Oran. 1:400,000=6.3 miles to an inch. In colors. Dressée par ordre de M. C. Jonnart, Gouverneur Général. Service Cartographique. 1909. [Shows routes in operation or construction, gauge of R.R. tracks, the national and common wagon roads, etc. Distances on the national and rail routes are given for every ten kilometers. An inset on sheet c shows the extension of the railroad in southern Oran to Kenadsa and the branch line reaching still farther south and, at present, terminating at Taghit.]

ALGERIA. Algérie. 1:200,000=3.1 miles to an inch. Contour interval, 100 M. In colors. Sheets 3, Miliana; 4, Alger; 5, Djurjura; 7, Constantine; 13, Boghari; 14, Bou-Saada. Dressée par ordre Monsieur Jonnart, Gouverneur Général de l'Algérie, au Service Cartographique du Gouvernement Général de l'Algérie. Alger, [1908-1910]. 1 franc a sheet. [A good general map of Algeria with large nomenclature, many rail and wagon routes, topography, forest and dune areas, irrigible regions and much minute information as the location of ruins, cemetaries, mills, etc.]

BASUTOLAND. Maseru—Sheet 129-J. 1:250,000=3.95 miles to an inch. Contour interval approximately, 100 feet. In colors. Surveyed in 1906. War Office, Geographical Section, General Staff, London, 1910. 1s. 6d. net.

BRITISH EAST AFRICA Protectorate. (a) Nairobi and the Surrounding Country. 1:62,500=0.9 mile to an inch. Contour interval about 50 feet, 1s. 6d. net; (b) Nairobi, 1:125,000=1.9 mile to an inch. Contour interval, approximately, 100 feet. 2s. net. Surveyed under the Direction of the Director of Surveys, East Africa Protectorate, in 1909, and printed at the War Office, London, 1910. [These maps are among the first fruits of the Topographical Survey in this Protectorate. They are good maps, though, as the field force is small, not of the highest degree of exactitude. Heights, for example, except those of trigonometrical points, are only approximate.]

CAPE OF GOOD HOPE. Geological Map of the Colony of the Cape of Good Hope. 1:238,000=3.75 miles to an inch. In colors. Sheets 32 (Van Wyk's Vlei) and 40 (Marydale). With profiles. Geological Commission, Cape Town, 1910.

EGYPT. Egypt. 1:50,000=0.7 mile to an inch. Sheets: IV-II, IV-III, N.W.; V-II, V-III, N. W.; VI-II, VI-III, VI-IV, VI-V, N. W.; VII-II, VII-III, VII-IV, VII-V, N. W.; XXXIV-VIII, S. E.; XXXV-VII, XXX-VIII, S. E.; XXXVI-VII, S.E.; XXXVII-IV, XXXVII-VII, S.E.; XXXIX-IV, S.E. Survey Dept., Cairo, Egypt, 1908-1909.

GOLD COAST. Map of the West African Goldfields. Compiled by A. J. Clevely from the Gold Coast Maps in 1:125,000, with the latest information of the Mining Companies. 1 inch=4 miles. In colors. A. J. Clevely, 30 Ranelagh Gds., Ilford, England, 1909. £1, 1s. [Names of the gold fields and of the companies working them are given. Means of communications are shown and the area embraced in the map extends from Kumasi to the coast and from the Ankobra river to Cape Coast.]

SOUTHERN RHODESIA. Map of [Southern] Rhodesia. 1 inch=12 miles. With inset of Northeastern Rhodesia, Northwestern Rhodesia and the N. W.

part of Southern Rhodesia. 1 inch=52 miles. Two sheets. In colors. A. J. Clevely, Ilford, Essex, England, 1910. £1, 1s. [This is the latest of Mr. Clevely's fine series of mining maps showing, on a large scale, the location and area covered by each of the mining properties on the Rand, in Southern Rhodesia and in the Gold Coast Crown Colony. Hill features are not shown on any of these maps, as the effort is to make the clearest possible delineation of the mining properties. The inset on the Rhodesia map shows the location of the mining enterprises in the two northern divisions of Rhodesia. The map gives a clear idea of the wonderful growth and spread of the mining industry in this part of British Africa, and of the railroads and rivers that are making them accessible.]

Transvaal Colony. Map of the Witwatersrand Goldfields. 1 inch=5,000 feet. Two sheets. Seven colors. A. J. Clevely, Ilford, Essex, England, 1909. £1, 1s. [Shows the position and extent of the various mines along about sixty miles of the Rand, from Randfontein on the West to Holfontein on the East.]

ASIA

Japan. Geological Survey of Japan. Sheets Hiwasa, Kanazawa, Matsuyama, Nobeoka. Scale, 1:200,000=3.1 miles to an inch. In colors. Contour interval, 40 meters. Tokio, 1909-1910.

EUROPE

Europe. Hand und Reisekarte von Europa. 1:7,500,000=118.35 miles to an inch. In colors. G. Freytag & Berndt, Vienna, 1910. Linen mounted, in pocket form, K. 5. [A fine, clear map of the continent with mountains in hachures, heights in meters, limits of river navigation and routes in red with the important places along them.]

Austria-Hungary. Karte der diözese St. Pölten. Herausgegeben unter dem Bischofe Dr. Johannes Rössler. 1:200,000=3.1 miles to an inch. In colors. G. Freytag & Berndt, Vienna, 1910. Mounted on linen with rollers, K. 10. [Full ecclesiastical information in red, imposed upon a very detailed map of the Diocese.]

Austria-Hungary. II. Bezirk-Leopoldstadt. 1:25,000=0.3 mile to an inch; III. Bezirk-Landstrasse. 1:15,000=12.50 feet to an inch; XVI. Bezirk Ottakring. 1:20,000. G. Freytag & Berndt, Vienna, 1910. [Examples of G. Freytag's Wiener Bezirksplankarten, on large scales, for use in the Vienna schools.]

Austria-Hungary. Reise-und Wanderkarte für das Salzkammergut Salzburg und Osttirol. Bearbeitet von G. Freytag. 1:250,000=3.95 miles to an inch. In colors. G. Freytag & Berndt, Vienna. On linen, K. 5.60. [Mountains in brown wash, heights in meters and very large nomenclature.]

Germany. Übersichts-karte der Verwaltungs-Bezirke der Königl. Preuss. Eisenbahn-Direktionen und der Königl. Preuss. und Grossherzl. Hess. Eisenbahn-Direktion in Mainz. 1:1,000,000=15.78 miles to an inch. 4 sheets. In colors. Bearbeitet im Ministerium der öffentlichen Arbeiten. Max Pasch Verlagsbuchhandlung, Berlin, 1910. [An official map of the railroads of Germany. Those routes whose administration is centered in Prussia and in some other parts of the empire are colored to show to which administrative district they belong and the cities from which their operations are controlled. Insets of sixteen cities show, in large detail, the lines centering in them.]